Yale University

RESPONSE FROM ECOSYSTEM

Request for Proposal for Science Hill Energy Services

July 12, 2023

30 years | ecosystem

ecosystem

Mr. Michael Ghilani, P.E.
Senior Energy Engineer
Yale University
2 Whitney Avenue
New Haven, CT 06510

Dear Mr. Ghilani, P.E.

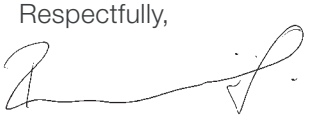
Ecosystem Energy Services eagerly anticipates the opportunity to develop a long-term partnership with you and your team. Based on the information included in the RFP and what you and Mr. Kosior presented during the site visit, it is abundantly clear that the Yale team is looking for a strong partner; one seasoned team with extensive experience working in complex energy ecosystems and a long history of delivering outstanding results for similar large, holistic projects. I am extremely confident in Ecosystem's ability to be that company you want and need - a partner responsible for designing and implementing transformational projects to advance and achieve your ambitious sustainability and energy reduction goals.

Ecosystem is the leading integrated design-build solutions provider in North America's Higher Education market. Our experience has informed us on best practices from planning and designing through implementing innovative solutions that maximize the results for our client's most important outcomes. It is what we have mastered. The foundation for each of our projects is a strong relationship developed through the view of a long lens. We know that being customer-centric and collaborative, with an open and active communication style, are must-haves. Combined with an outcome-based, results-driven approach, these are all key cornerstone elements contributing to the success of each project. We thoroughly enjoy and are passionate about developing strong relationships that turn into long-term partnerships!

Together, we envision combining Ecosystem's three decades of experience with Yale's deep knowledge of your campus and future vision, to shape and guide the direction and ultimately the success of each project. Our partnership should satisfy the needs of all stakeholders involved while achieving Yale's ambitious goals in the most professionally rewarding ways.

It is important we are aligned on what a partnership means collectively, as a team. To help improve an alignment of interests between Yale and Ecosystem, you will find our comments in the Project Agreement section. We look forward to discussing the finer points for developing a long-term, mutually beneficial partnership and are excited about all that we can accomplish together.

Respectfully,



Bob Mancini
Director of Business Development, Higher Education
rmancini@ecosystem-energy.com
401-808-0589

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Executive Summary

Your goals are our goals.

Yale University has demonstrated its commitment to addressing the urgent challenges posed by climate change through the implementation of a comprehensive climate action strategy, setting the goal of reducing actual emissions to zero by no later than 2050. The success of this project goes beyond your immediate goals of decarbonization and energy use intensity (EUI) reduction and supports Yale's nine ambitions as listed in the Sustainability Plan 2025.

At Ecosystem, we share your commitment to the energy transition and promote sustainable energy practices through the decarbonization of the built environment. We thrive on providing our clients with innovative solutions that reduce greenhouse gas (GHG) emissions as efficiently as possible. Over the last 30 years, we have helped our clients avoid over 880K mTons in GHGs and have achieved over $645M in measurable energy savings.

Our company was founded on the conviction that everything can be more efficient, not just the buildings in which we live, play, study, or work in but also how they are built, including the contractual relationships that are so critical to success. This is why we commit to results on every project we do: as engineers, we know that no one is better positioned to be accountable for these outcomes. Those beliefs are the foundation of our integrated approach to design and construction.

Strategic & innovative design solutions.

Experienced project implementation.

Outstanding results.

The value of our integrated approach

- Ecosystem's singular focus on the design, implementation, and optimization of highly efficient buildings has allowed us to build multidisciplinary teams of staff specialized for each phase of energy performance projects.
- Disciplined and agile engineering practices, coupled with effective project construction management, allow us to extract maximum value.
- We offer a single point of accountability, and our integrated team has the capacity and expertise to deliver the expected results.

- Ecosystem can remain agile throughout the design and subsequent construction phases of the project. This agility is vital to foster innovation and adaptability to any new information, while better managing the overall project cost.
- Our project leaders are always experienced designers and construction managers. The construction managers join the project when the design is about 30% complete, adding implementation experience to the design process, and our designers remain involved until construction is around 80% complete, to ensure that any on-site changes can be implemented seamlessly.

The depth and experience of our team

- Our engineers are experienced in both design and construction management – which enables agility, lean management, fast tracking, increased constructability in the design, and decreased transaction costs by reducing scope changes and inflated contingency between project steps.
- The Ecosystem team proposed for this project has worked on numerous campus projects, including Brown, Vassar, Tufts, Georgetown, Adelphi, DePauw, Humber College, University of Toronto, and The Ohio State University.
- Our case studies, in the appendices, are evidence of our deep experience with projects similar to yours.

Our proven approach to EUI reduction and decarbonization projects

- Yale is looking for a partner to implement zero-carbon readiness projects, with building conversions to low-temperature hot water and deep-retrofit EUI reduction projects. This has been our core business for 30 years.
- Our three-tiered project development approach will ensure that Yale achieves its goals.

Conservation first:

- Focus on eliminating waste at the source to help reduce building EUI

Building conversion:

- Fully understanding the building to convert from steam to hot water

Carbon reduction – electrification and renewable energy:

- Once waste is eliminated and optimal building temperatures are achieved, utilize low carbon sources of heating and integrating renewable energy to further decarbonize

> “Ecosystem has a different approach. They really spend a lot of time looking at the systems, understanding the systems, and interacting with the staff. They make sure they have a lot of information before making their recommendation. They bounce ideas off of everyone who is part of the project

STEVE MONEZ,
Assistant Vice President,
Corporate Engineering,
Mount Sinai Health System

- We have developed effective strategies for work on live campus and critical care hospital environments, including laboratory medical spaces requiring additional sensitivity.

Our commitment to genuine collaboration and partnership

- In the Project Agreement section, we are proposing an approach that will enhance alignment of interests, foster transparency, and promote risk sharing.
- We are passionate about what we do and love sharing our knowledge with students, faculty, staff, and communities. Our projects can serve as a living lab for students, and outreach and awareness programs can amplify Yale's environmental stewardship on campus and beyond.

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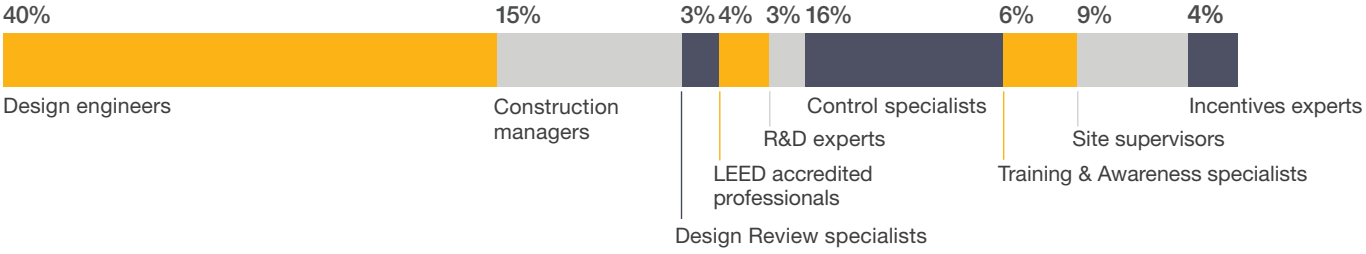
Team Profile

Ecosystem's People

Our people share the common belief that everything can be more efficient. The foundation of this is that as engineers, we should be accountable for results. Ecosystem's singular focus on the comprehensive design, implementation, and optimization of highly efficient buildings allows us to build multidisciplinary teams that include specialists for each phase of our projects. These teams include engineers, CEMs, CMVPs, drawings experts, construction managers, site supervisors, commissioning specialists, and specialized groups dedicated to incentives, savings tracking and verification, awareness programs, and technical training programs. Our in-house capabilities generate efficiencies and a communal body of knowledge, creating significant value for our clients from the study phase through project implementation.

Our expertise is based on the comprehensive technical knowledge and understanding of our multidisciplinary staff combined with the insight we have gained from every energy conservation measure (ECM) we have designed, implemented, optimized, and monitored over the past 30 years. Our specialized knowledge base, unique in North America, enables us to deliver optimal results.



An Integrated Approach

At Ecosystem, we have created an environment where our people are trained to deliver projects from beginning to end, across multiple disciplines, buildings, and types. Our people have the overlapping skill sets required to efficiently deliver complex energy projects. For instance, our engineers are experienced in both design and construction management –

which enables agility, lean management, fast tracking, increased constructability in the design, and decreased transaction costs by reducing scope changes and inflated contingency between project steps. All our senior project directors are experienced designers and construction managers. To complement this, the construction manager joins the project when the design is about 30% complete, adding implementation experience to the design process, and our designers remain involved until construction is around 80% complete, to ensure that any on-site changes can be implemented seamlessly.

As illustrated in the organizational chart provided, we function as a cohesive team, consistently leveraging the skills and expertise of a core group of individuals who have cultivated their expertise over years of completing projects similar to yours. The design and construction teams at Ecosystem are fully integrated – they work together on all phases of the project to ensure seamless communication and execution.

Constant Collaboration with Yale University

Constant collaboration with all Yale stakeholders will be instrumental in the success of the project. We align ourselves with Yale so that we can serve as an extension of your team in the planning, design, and implementation. Over the years, we have found that the most successful projects are the result of effective collaboration from the beginning. This collaboration will start prior to the execution of the contract and permeate through all Yale's departments and stakeholders. We appreciate that this type of partnership requires sensitivity, and sometimes discretion, when working with teams that take great pride and ownership of their work at Yale.

At Ecosystem, our dedicated team is completely committed to delivering tangible, outstanding results Yale. We recognize that our clients' success is our success, and this drives our unwavering focus on achieving their desired outcomes.

Key Personnel

Ecosystem has identified three contact points who will manage the project and facilitate the process.

Senior Project Director: Andre-Benoit Allard

Andre-Benoit will act as the senior resource, overseeing the engineering and implementation of the project while ensuring the proper transition between each of the phases. He will act as the team leader throughout the project's pre-design, design, construction, and commissioning phase.

Phone:1-401-578-2777
Email: aballard@ecosystem.ca

Senior Project Development Lead – Higher Education Sector: Jean-Philippe (JP) Drouin

JP will be involved in initiating and maintaining strong communication with all stakeholders to understand their goals and make sure that the technical designs are perfectly aligned with desired project outcomes.

Phone:1-418-570-5088
Email: jpdrouinbouffard@ecosystem.ca

Relationship Lead: Robert Mancini

Bob will be responsible for ensuring an exceptional experience beginning with the RFQ/RFP and contract execution phases, all the way through to project completion.

Phone: 1-401-808-0589
Email: rmancini@ecosystem-energy.com

Subject Matter Experts

In addition to our local engineers and construction managers, Ecosystem's teams of subject matter experts will be called upon regularly to help conceptualize, design, and implement specific measures and programs as needed. Our results-driven, integrated approach means that the people with the most relevant experience will be on-site and working within the team to deliver best-in-class projects.

About the Team

The team presented in the organizational chart will work to develop projects that will advance the university's goals. This team was selected based on their combined multidisciplinary experience in higher education. Throughout the process, the team will collaborate on all aspects of the project to ensure a smooth transition and project delivery.

> “It was important to us to have the right people at the table who thought big and thought differently, who looked around the globe at what was coming in terms of technology and approaches. This is one of the places Ecosystem shines.

JESSICA BERRY
Assistant Vice President, Office of Sustainability and Resiliency, Brown University

Your Ecosystem Team

Andre-Benoit Allard
Senior Project Director

Jean-Philippe Drouin
Project Executive

Robert Mancini
Relationship Lead

Pre-Design & Design Team

David Bonneau
Lead Design Engineer

Simon Lessard
Lead Design Engineer

Max Lamirande
Senior Project Engineer

Lucas Taub
Project Engineer

Gabrielle Turcot, Ph.D.
Project Engineer

Subject Matter Experts

Richard Tremblay
Cofounder

Simon Lessard
Senior Director Technical Solutions

Jean-Philippe Guay
Team Lead – Electrical Engineering

Daniel Robidoux
Project Support Specialist

Jerome Harvey-Bergeron
Director Health & Safety

Gabriel Teyssedou
Senior Project Director

Construction Team

Kevin Fortin
Construction Director

Trevor Smith
Construction Manager
*Licensed PE in CT

Max Lamirande
Senior Project Engineer

Ted Holden
Site Supervisor

Incentives

Adam Shelly
Project Development Director

Controls & Commissioning

Marc Trepanier
Senior Mechanical Systems Optimization Specialist

Adam Zielinski
Senior Mechanical Systems Optimization

Community Awareness

Stephanie Schwartz
Communication and Marketing Director

*CVs can be found in Appendix A.

Case Studies & References

Attached in Appendix B are case studies that highlight Ecosystem's expertise and ability to design integrated systems for optimal performance. Yale is looking for a partner to implement zero-carbon readiness projects, with building conversions to low-temperature hot water and deep-retrofit EUI reduction projects. This has been our core business for 30 years; our clients can attest to our professionalism, expertise, and commitment to delivering outstanding results.

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Project Approach

The following sections outline Ecosystem's proposed strategy to ensure Yale meets the objectives stated in the Science Hill Energy Services RFP. While we recognize that a crucial aspect of the project entails converting steam to hot water, a process we have successfully accomplished in critical facilities for many years, we also acknowledge the importance of reducing the EUI in each of the six lab buildings to support Yale's future growth requirements on Science Hill. As demonstrated in this proposal, your approach to eliminating waste at the source aligns directly with Ecosystem's core beliefs, project development philosophy, and methodology. We also understand that the research conducted at Yale is crucial to its mission and recognize that the design and implementation of these projects must be conducted without disruption to these activities.

Whole Building Approach, Deeper Retrofits

Ecosystem digs deeper into the whole building's energy infrastructure to unlock hidden value and the full savings potential. In collaboration with our clients' invaluable first-hand knowledge, our specialists redesign building systems (heating, cooling, ventilation, water, lighting, etc.) for peak efficiency. We also identify and integrate attractive opportunities for asset renewal and/or renewable energy. See Appendix C for more information on capturing asset value.

Focus on Outcomes

With three decades of experience in decarbonization projects and deep energy retrofits, Ecosystem has dedicated extensive time to developing and refining our own strategies and innovations based around the concept that engineers need to be in charge and accountable; therefore, we take an integrated engineering and construction approach. Our focus is on delivering results, and we have tailored an agile methodology for developing, designing, implementing, and optimizing projects, one very suited to laboratory environments across higher education and healthcare.

In this section, we delve into how our approach aligns with Yale's goals and requirements, ensuring EUI reduction and zero-carbon readiness of the selected laboratory buildings.

Ecosystem operates as a fully integrated team, and our mindset centers on achieving outcomes rather than merely following a checklist. We understand that project success hinges on clearly defined goals and outcomes established from the project's inception. Drawing from our 30 years of experience in the construction industry, we recognize that adhering to disciplined and agile engineering practices, coupled with effective project management, allows us to extract maximum value from each undertaking. Our belief in our ability to continually enhance and improve project results motivates our integrated teams.

An exemplary demonstration of the way our approach yields tangible outcomes is our project in the first LEED Platinum-certified new construction building in Quebec, the Center for Sustainable Development in Montreal (see Appendix B for case study). The building was constructed to high standards, yet despite the incorporation of cutting-edge technologies, its energy performance was disappointing, especially considering its mission. Ecosystem was able to achieve an additional 33% reduction in energy consumption and a 90% reduction in greenhouse gas emissions.

Three-Tiered Approach

At Ecosystem, we approach energy efficiency and decarbonization projects with a comprehensive and systematic methodology. Our focus lies in three key areas: Conservation First; Building Conversion; and Carbon Reduction through Electrification. By employing this approach, we aim to optimize energy savings and performance, minimize waste, and reduce carbon emissions.

1. Conservation First

We target building-side energy consumption, EUI, and demand through energy conservation measures (ECMs). These typically include lighting, controls optimization/upgrades, improvements to building envelopes, etc.; even if many of these ECMs have been done in the past, we often find additional opportunities for efficiency. By eliminating waste at the source, we not only improve the financial performance of the project but also avoid oversizing renewable generation sources. As we design the ECMs, we assess the existing infrastructure to determine whether any elements or components can be reused or repurposed within the guidelines of Yale's building standards. The approach not only accelerates project timelines but also reduces disruption, improves system performance, reduces waste, and lowers cost.

2. Building Conversion

To ensure effective building conversion, we begin by deeply understanding the thermal loads. This includes identifying their nature (terminal reheat coil, pre-heat coil, peripheral unit, domestic hot water, process loads, etc.), energy use profile (demand, winter demand, summer demand), location in the building, original design characteristics (are they oversized or not), and their actual performance (can they take lower temperatures and still meet the demand, and if so, at what lower temperature and under what external conditions). We do

the same for the in-building piping system, considering factors such as condition, pipe size, and life expectancy. Armed with this detailed understanding, we conduct data-driven scenario analysis to identify the optimal approach. Some scenarios might attempt to reduce hot-water temperatures to a certain point by reusing more assets in the building (such as coils and pipes), whereas others will model the replacement of more assets to reach even lower temperatures. Sometimes, through a good understanding of the loads and seasonal testing, we find that certain buildings can take a lower temperature by changing only a fraction of the assets instead of replacing all building components, saving significant costs.

We perform lifecycle cost analyses and compare scenarios based on Capex and Opex to get a holistic view. For instance, lower hot-water temperature profiles will result in more efficient heat pump operation and a lower Opex, while a bigger building ΔT will result in smaller district piping and lower Capex. On this basis, we can identify the optimal hot-water temperature profile to minimize Capex in building conversions, as well as Opex at the plant. We find that this systematic approach usually delivers the most cost-effective concept. We always strive to identify the scenario that maximizes the desired outcomes in a building conversion. By performing lifecycle cost analysis and comparing scenarios based on their capital expenditures and operating expenditures, we arrive at the most cost-effective and efficient concept, and best long-term value, for building conversion.

3. **Carbon Reduction – Electrification**

   Once waste has been eliminated at the source, we shift our focus to reducing the use of fossil fuels. In healthcare and higher education settings, we leverage simultaneous heating and cooling opportunities to minimize the reliance on boilers and chillers. Given the high use of absorption chillers at the campus, we will look to maximize the utilization of heat recovery chillers and capture waste heat as applicable.

By employing this comprehensive approach, Ecosystem aims to achieve optimal energy performance, reduce waste, and lower carbon emissions in buildings. We are committed to delivering results that align with our clients' goals while prioritizing financial efficiency, sustainability, and environmental stewardship. To promote this, we typically include key milestones in our process.

The following section outlines Ecosystem's approach in detail, tailored specifically to the requirements outlined in the RFP. Additionally, we have proposed a milestone-based approach in the Project Agreement section of this document for Yale's consideration. We believe that this milestone-based process will foster transparency and alignment of interests among all parties while promoting the innovation required to achieve the performance outcomes for Yale's EUI reduction, zero-carbon readiness project.

Pre-Design

The pre-design phase establishes a comprehensive plan and determines the need for any additional steps before progressing to the detailed design phase. During this discovery stage, we dedicate time to thoroughly investigate the operational aspects of the buildings and trace the flow of energy from entering the building to the end-user. This understanding is essential to achieving high-performance buildings and implementing deep energy retrofits successfully. It is even more crucial when looking at steam to hot water conversion. Drawing from our expertise in designing and executing such projects, we can develop cost and savings estimates with precision.

As part of our concept development process, our in-house team of engineers will conduct audits for each lab building. Leveraging existing energy data and insights gathered during audits, we conduct an in-depth analysis of the building's energy systems' performance. Our primary focus is to enhance the building's energy efficiency by minimizing on-site waste. This analysis, combined with extensive stakeholder discussions, forms the foundation of our proposed solutions.

At this stage, we explore all possible options and incorporate an analysis of deferred maintenance needs, Yale's future growth requirements, and any external factors that may impact the project. This holistic approach ensures that our project is comprehensive and aligned with Yale's long-term vision. Specifically, the pre-design phase will address the following:

1. Building Review

The initial phase of the process entails a comprehensive review of all available information on the associated buildings. This includes, but is not limited to, review of as-built drawings, commissioning reports and balancing reports, energy data, and utility information. Multiple site visits and equipment audits will be conducted to gain a thorough understanding of the building's operations, both during occupancy and in unoccupied states.

In addition to the review, a detailed walk-through will be conducted to observe existing conditions. While as-built drawings provide valuable information, they are not sufficient on their own, especially when considering steam to hot water conversions.

2. Investigation Plan

Upon analyzing the existing information, Ecosystem will develop a comprehensive investigation plan. While additional resources, such as air balancing and testing contractors, could be required, this has rarely been necessary at this stage of project development, based on other similar

projects Ecosystem has completed. Existing information that is anticipated, based on discussions during the site visit and subsequent RFI response, should provide ample data to develop a thorough project scope, encompassing both CAPEX and OPEX estimates.

Submetering requirements

The submetering requirements will be based on the available information from the facilities. Our initial step involves examining building management system (BMS) trends and information to specifically identify the areas that require submetering, if any. Typical submetering efforts include the installation of BTU meters and monitoring/clipping existing drives on HVAC systems, for example. If submetering needs extend beyond the physical installation of BTU meters and clipping of electrical panels, we will identify these requirements during this stage of the project.

Laboratory-specific investigation

Recognizing the diverse applications, end uses, and sensitive nature of laboratory environments, Ecosystem places utmost importance on close collaboration with the facilities and faculty teams to ensure seamless coordination of required audits while minimizing disruption to ongoing operations. In laboratories, energy consumption and safety considerations are primarily driven by fume hoods and air changes. Therefore, our investigations begin with a proper understanding of these systems and the specific requirements for each end-user.

The general investigation process begins by reviewing all available data, including drawings, HVAC balancing reports, utility information, and details extracted from the BMS. Moreover, gaining a proper understanding of the contaminants involved and the nature of ongoing research is crucial to properly design and optimize the systems in a safe and effective manner. Once the initial data is collected and analyzed, a plan is formulated, and we will work in collaboration with on-site staff to schedule initial site visits, enabling us to identify potential solutions. These visits provide valuable insights into the actual operation of the laboratories, including aspects such as proper air flow (negative vs positive pressurization) and fume hood utilization (variable or fixed, potential bypass issues, etc.). In many cases, laboratory spaces have been modified over time to accommodate growth and new research, while the original ventilation systems remain relatively untouched. This can cause airflow challenges that not only increase energy consumption but also pose safety risks. During these investigations, time is taken to validate the proper airflow patterns and ensure that the fume hoods, general exhaust, and diffusers are functioning as intended.

Additionally, a code review is also conducted to evaluate the proper air changes and determine if reduction is possible. ASHRAE standards, Yale's laboratory design requirements, and other codes and guidelines such

as ANSI and NFPA, are analyzed to assess the potential for air change reduction based on biosafety levels and laboratory ventilation design requirements.

Our in-house team uses these on-site investigations to understand the level of complexity that will be required for each ECM to be implemented, which helps develop accurate project costs. Specific equipment and/or items that are investigated in the laboratories are included, but not limited to:

- Supply airflow rates
- Number and location of fume hoods, diffusers (including type), and exhaust grills
- General heating and cooling systems
- Type of contaminant(s)

To summarize, our approach to laboratory analysis can be described as follows:

1. Understand the end users' needs and safety requirements of specific laboratories
2. Develop a code review chart for each laboratory that includes the required air change per hour based on needs and safety
3. Investigate specific laboratory equipment and airflow patterns
4. Develop an energy model with the potential impacts of various ECMs
5. Focus on reducing waste at the source, followed by heat recovery and low-temperature hot water conversions

3. Calibrated Energy Model

Ecosystem's approach to energy modeling is rooted in our extensive implementation experience. Drawing from 30 years of designing, implementing, and guaranteeing results, we have developed highly efficient methods for modeling actual building usage and assessing the impact of various ECMs, such as transitioning from steam and high-temperature hot water systems to low-temperature hot water systems and electrification.

Our energy modeling process begins with an extensive building survey to accurately identify building characteristics, energy-consuming equipment, submetering and occupancy patterns, and/or usage. Data is collected from the BMS when available, as well as utility bills. Subsequently, a detailed energy model (based on bin hours of 8,760 hours) reflecting the previous information is designed and calibrated to ensure its accuracy and provide a holistic view.

We have devised methods to identify implementation costs for low-temperature hot water conversions and other ECMs. Alongside the energy model, we can deliver precise project savings and implementation costs, all based on actual project implementation data. Our experience includes using modeling software such as HAP, eQuest, and EnergyPlus, which can help maximize tax benefits and leverage specific incentives.

While energy models may include hourly analysis, it is not always necessary. Ecosystem has achieved success using bin-hour models. These models will be continuously refined throughout the process, and should hourly models be necessary, they will be developed in a collaborative manner with Yale's team.

It is important to note that even the most complex energy models can still have a margin of error. At Ecosystem, we focus our efforts on properly understanding how the building functions and where the energy is being consumed, as established in the earlier steps. This allows us to develop a building model that accurately represents the existing conditions.

4. Energy Conservation Analysis

Throughout every step of the project, we consistently consider potential ECMs, even during the construction phase. Because we are a fully integrated company, we can suggest solutions that maximize energy savings and carbon reduction, seamlessly integrating them into the construction process. This is one of the advantages of maintaining alignment with the goals set out at the beginning of the project.

Our standard approach in developing ECMs involves providing a life cycle cost analysis for each option. This process, once again, is completed in a collaborative manner to ensure that the ECMs presented are in line with the goals and needs of Yale's team. By working closely, we can tailor the ECMs to suit the specific needs and objectives of the project.

5. Renewable Energy Analysis

As we are developing ECMs to eliminate waste at the source, Ecosystem will also conduct an analysis to assess the feasibility of reducing the heating hot water temperature in buildings to align with the new central plant project that will supply low-temperature hot water within the range of 120-140°F. This analysis will be carried out in conjunction with the steam to hot water analysis. A similar approach is being employed with Brown University to determine the optimal temperature network and scope of work required to transition their system to low-temperature hot water.

The final step in the holistic energy analysis is to evaluate the potential for on-site renewable energy sources. Typically, we prioritize this assessment after all feasible energy waste reduction measures have been imple-

mented. This ensures that the potential renewable energy systems are not oversized and minimizes the associated CAPEX costs. By following this approach, we optimize the balance between energy efficiency improvements and the integration of renewable energy solutions.

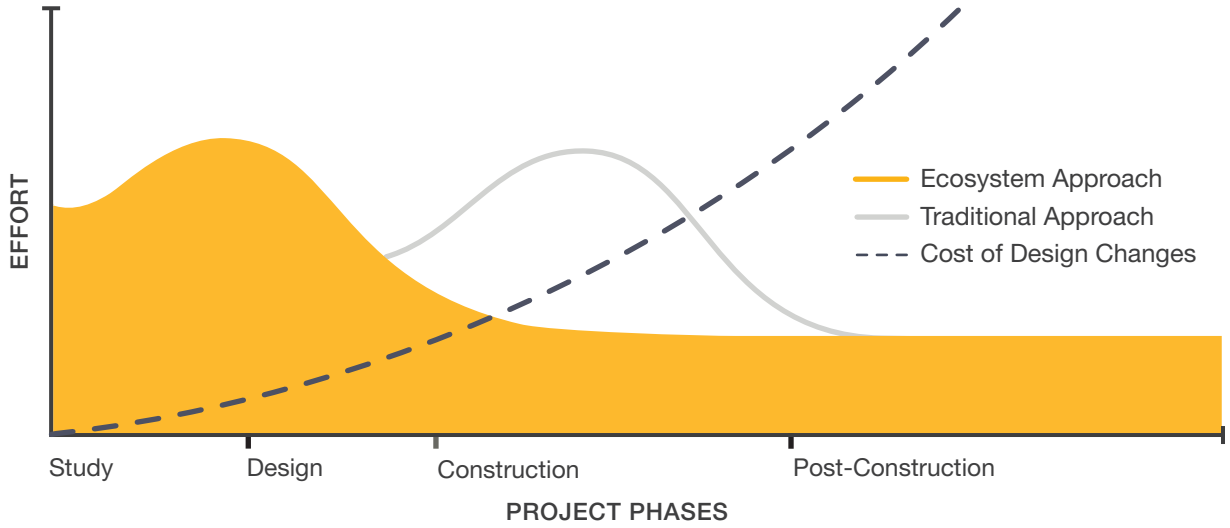
6. Investigation Report

Upon completion, a comprehensive final report with recommendations will be submitted to the Yale team. It is important to highlight that this report will remain dynamic throughout the entire pre-design phase, evolving as a result of ongoing collaboration between Ecosystem and Yale.

Design & Procurement

The design phase focuses on refining the conceptual designs (20%) developed during the pre-design phase. Collaborative working sessions between Ecosystem and Yale will continue to foster transparency in the project development process. During this stage, subcontractors will be invited to validate the project costs, and equipment selection and vendor quotes will be obtained. Our typical approach is to provide +/-25% project estimates during the pre-design phase and refine them to +/-15% at the first gate during the design phase. A working session with Yale will ensure that project KPIs are still being met. Following this working session, Ecosystem will develop final project numbers based on 50% design documents, reviewed in collaboration with Yale. For a more detailed description of the pre-contract phase, please refer to the Project Agreement section of this document.

One advantage of our proposed approach is the ability to remain agile throughout the design and subsequent construction phases of the project. This agility is vital to foster innovation and adaptability to any new



information that may emerge during the design phase, while effectively managing the overall project cost. By dedicating more time to the design phase, we ensure that the project requirements and goals are successfully achieved.

Subcontractors: The Advantage of Ecosystem's In-House Capabilities

Ecosystem's singular focus on the design, implementation, and optimization of highly efficient buildings has allowed us to build multidisciplinary teams of staff specialized for each phase of energy performance projects. A single point of responsibility reduces overall costs and risk to Yale, while encouraging efficacy and innovation.

Ecosystem is strictly vendor-neutral and is not engaged in the sales of any products, working only with subcontractors and suppliers whose products and services fit each client's unique needs best. This allows for complete flexibility in subcontractor and equipment selection without the constraint of a vested interest. In addition, we do not select subcontractors until the project design is complete, to ensure that the design is not tailored to subcontractor preferences and that we are contracting the right trades for the job.

We invite qualified subcontractors and suppliers by issuing a fully defined bid package. Our goal is to ensure that we receive the best quality of labor while controlling costs. We place a high priority on engaging local subcontractors, particularly those who have strong working relationships with Yale and have extensive knowledge of both the region and facilities. Over the years, we have cultivated partnerships with reputable contractors in the region. However, we remain committed to exploring opportunities with new qualified subcontractors and suppliers as well.

Selection for this project will be based upon Ecosystem's scoring of subcontractor capability and experience (particularly experience on local higher education projects, if applicable), location of the subcontractor, subcontractor cost, and fulfillment of any diversity requirements.

Diversity, equity, and inclusion are extremely important to Ecosystem. We value the strength that comes from diversity in our people and our partners. As a result, to make our subcontractor base even more diverse, we have implemented several initiatives, such as tracking MWBE partners. To ensure smooth communication and accommodate various backgrounds, essential worksite information is available in Spanish as well as English.

The table on the following page indicates the types of services implemented by Ecosystem and by subcontractors in most of our projects.

Services Performed by Ecosystem & Subcontracted Services

Project Phases	% Ecosystem	% Subcontracted
Utility bill analysis	100	
Preliminary study	100	
Detailed study	100	
Concept design	100	
Schematic design	100	
Drawings and tender package	50	50
Tender	100	
Bid analysis	100	
Project management	100	
Construction management	100	
Site supervisor during construction	100	
Procurement (equipment, labor, services)	100	
Labor, trades, etc.		100
Weekly project team meetings	100	
Field review	80	20
Commissioning	100	
Optimization	100	
Project closeout	100	
Performance guarantee	100	
Ongoing support to operations	80	20
Periodic site review	100	
Monitoring and verification	100	
Reconciliation of savings	100	

Construction

Safety First

Safety is a core priority for Ecosystem, and we place the utmost importance on the well-being of workers and occupants throughout project implementation. We employ a set of vital processes to ensure regulatory compliance and seamless coordination with your team during construction.

Ecosystem's health and safety prevention program: Ecosystem will develop a health and safety program that aligns with relevant regulations. This program addresses legal requirements while tailoring site-specific prevention strategies for each work site.

Forms, procedures, and work plans: To facilitate effective communications and adhere to health and safety procedures, we employ various forms, procedures, and work plans. These encompass mandatory safety worksite orientations, safety break meetings, site audits, permits for hot water, and procedures for working in confined spaces, among others. Work plans are implemented in conjunction with subcontractors, requiring approval prior to commencing work.

Site safety audits and disciplinary measures: Rigorous site safety audits are conducted monthly by our construction manager, supplemented by daily inspections from site supervisors. Any instances of noncompliance are meticulously documented, with site supervisors engaging in dialogue with non-compliant workers to address the violated regulations, ensuring the comprehension of the risk. In cases of recurring problems, Ecosystem issues written notices to subcontractors and may impose disciplinary measures.

Safety compliance verification and internal audits: Internal audits are conducted monthly. Ecosystem's project director, working closely with the OHS director, verifies that safety activities have been performed and recorded accordingly by our field teams.

Best Practices

Every Ecosystem project has been completed in occupied buildings, including many universities and critical-care facilities that require uninterrupted operability. This experience has allowed the company to develop an exceptional level of expertise in dealing with the unique challenges of restrictive and sensitive work environments. We understand that "live" environments and that each building's energy system is unique, and most importantly, that building occupants and activities must be respected.

Dedicated Ecosystem construction engineers will manage all on-site work and communication with Yale with the constant support of the design team. Because of the non-siloed nature of Ecosystem, we are able to react to on-site conditions and change the design as needed, always focusing on the desired outcomes of the project.

One major benefit of our integrated engineering and construction approach is our ability to design and plan with specific results in mind. This allows us to create phasing and construction plans that are more efficient and faster than those created by teams that are siloed between design and construction.

We have also developed many construction best practices to minimize the impacts, such as:

- To shorten the duration of service interruptions and facilitate connections, piping is passed as close as possible to the connection points.
- The conversion is performed zone by zone, system by system. The intervention plan is customized based on the needs of each zone. The work teams are strategically scheduled to reduce the intervention time in each sector.

During our OSU project, for example, the operational impact was considered in terms of interruptions, disruptions, and ease of maintenance. A focus on avoiding shutdowns minimized campus interruptions through careful scheduling. Scheduling is set up well in advance of the project approval. As such, the implementation strategy is oriented toward minimizing any downtime.

Performance-Based Commissioning

Our in-house commissioning process is designed to optimize system performance by programming sequences of operation based on our comprehensive understanding of the entire building's systems. The start-up and optimization phase is crucial in all our projects. Our in-house team of control specialists excels at reconfiguring and fine-tuning sequences of operation and maintains constant contact with your operations staff to test and validate system performance.

During the Commissioning and Optimization period, Ecosystem utilizes a proactive approach to ensure that all equipment and control systems function as intended, mitigating potential long-term issues that may arise post-project completion. As part of this phase, we maintain close involvement and collaboration with the university's staff.

Our commissioning process adheres to industry-leading standards, and we prepare a comprehensive document package in coordination with the project management team. We employ commissioning check-sheet templates to document inspections, tests, contractors' start-up programs, verification, performance evaluation, and balancing reports. The operations and maintenance manuals are updated to reflect all changes to the affected systems. Our optimization team monitors equipment and systems to bolster reliability and efficiency, leveraging insights from our engineering team.

Upon project commencement, we assign a performance team led by a CMVP to monitor the implemented measures and report on savings. This team works closely with any third-party commissioning and M&V agent, if required. If deviations from the expected performance are observed, Ecosystem diligently investigates the root cause of the deficiency and takes necessary corrective measures. This approach ensures optimal performance of newly installed equipment and guarantees the maximum energy savings possible.

Additionally, as part of our commitment to measurement and verification, Ecosystem will continue to work with our clients throughout the contract duration. We firmly believe in the alignment of interests, and the long-term success of a project is a shared goal.

Training

One critical aspect of delivering high-quality engineering and construction services to your team is ensuring that the staff is fully trained and equipped to operate any new equipment or systems that we install in their existing buildings. To that end, we propose the following provisions for training Yale's staff:

Training Plan: Before any new equipment or systems are installed, we will develop a comprehensive training plan that outlines the necessary skills and knowledge required to operate and maintain them effectively. This plan will be tailored to the specific needs of Yale's staff, considering their level of experience and expertise.

Training Curriculum: Based on the training plan, we will develop a detailed training curriculum that covers all the essential aspects of operating and maintaining the new equipment or systems. This curriculum will be designed to be easily understandable, and it will be presented in a format that is accessible and engaging for all learners.

Training Materials: We will provide all necessary training materials, including manuals, guides, and videos, to support the training curriculum. These materials will be available in both digital and print formats and they will be updated regularly to ensure that they remain current and relevant.

Hands-On Training: In addition to providing training materials, we will also offer hands-on training sessions that allow Yale's staff to practice using the new equipment or systems in a real-world environment. These sessions will be led by experienced trainers who will provide guidance and feedback to ensure that the learners are mastering the necessary skills.

Ongoing Support: We understand that learning does not end with the completion of a training program. Therefore, we will provide ongoing support to Yale's staff to ensure that they can continue to operate and main-

tain the new equipment or systems effectively. This support will include access to technical experts, as well as additional training opportunities as needed.

Overall, we are committed to providing Yale with the highest quality engineering and construction services and we believe that a comprehensive training program is a critical component of achieving that goal. By providing Yale's staff with the knowledge and skills they need to operate and maintain new equipment and systems, we can ensure that their buildings continue to operate safely and efficiently for years to come.

4

Project Agreement

Ecosystem is proud to be invited to participate in Yale's ambitious zero-carbon readiness and EUI reduction project. Your EUI reduction targets of 50% are bold and decisive, and we share your confidence that, with the right approach, your goals are attainable.

There are three areas of focus that are crucial for decarbonization and EUI reduction efforts to succeed:

- True partnership and collaboration
- Transparency on both cost and outcomes
- Risk sharing mechanisms and alignment of interests

Partnership and Collaboration

In our experience, harnessing our collective expertise to co-develop solutions, then efficiently refining them through design thinking and integrative design methods, will lead to projects that deliver the results you seek and potentially more. We know and we heard at the site visit that Yale understands the critical importance of strong partnerships. However, we believe that the current contracting model – a cost-plus model that places all the risk with Yale and does not incentivize partners to seek efficiencies – will not promote the agile, collaborative partnership necessary to identify, design, and build projects that maximize outcomes.

This is why we propose changes to the proposed contract – to promote incentives to collaborate and design-build with the best outcomes in mind rather than be focused on billable hours. We always invest more time in upfront collaboration and project development so that our clients exceed their targets.

A co-developed solution enhances the overall quality and efficiency of project development and implementation. By dedicating time early on to understand your perspectives and deep knowledge of your facilities, we can tailor the right solutions for each building and avoid wasting valuable time on developing unsuitable alternatives. The true spirit of partnership is realized when we focus our collective intelligence on achieving the best possible outcomes for Yale. Your team knows your buildings in detail; our team brings experiences in numerous other contexts. Combining these strengths is very powerful.

Transparency

We also believe that it is crucial to maintain a balance between inputs and anticipated results. We fully recognize Yale's need for control and transparency; however, we propose that these principles should apply not only to the design and cost but also to the results.

An outcome-based contract can effectively focus attention on all critical project aspects, financial and otherwise. It is supported by a set of mutually agreed milestones, gates, and checkpoints. While your current RFP does outline certain milestones, adding additional checkpoints would afford Yale more comprehensive transparency and control. These project milestones will ensure Yale's active involvement from inception through to project completion, offering a granular view of the progress made at each stage.

Key Milestones

While the current RFP lists five key milestones, we believe including additional intermediate checkpoints will help achieve transparency and ensure constant collaboration among the team. These checkpoints should be developed mutually and should follow the project development approach. By integrating these critical milestones, the project team can cultivate collaboration, maintain transparency, and give all stakeholders control and visibility throughout the process, from initial design to final commissioning.

We have also included an alternative pre-contract process below for Yale's consideration. It follows a similar approach to the pre-design, design, procurement, and construction phases suggested in the RFP, but allows for more transparency throughout the process. (A more detailed list of milestones can be found at the end of this section.)

Pre-Design Kick-Off

Objective: Meet with stakeholders to determine project goals, objectives, and success criteria.

Conduct thorough discussions with stakeholders to understand objectives, requirements, and desired outcomes for the project. This establishes a clear understanding of the scope and goals from the outset. A list of goals and requirements is established, and the corresponding KPIs are approved. An often overlooked but important KPI to consider is the level of engagement of the teams on both sides; we find this to be an excellent predictor of project success.

Milestones: Agreed KPIs and project objectives

Collaborative Design Engineering and Project Management Development

Objective: Collaborate with Yale to develop the initial design concept. Obtain input and approval from all stakeholders (managers, engineering, plant operators, etc.) before proceeding to the next design phase.

Performance Modeling & Analysis: Conduct performance modeling and analysis to demonstrate the projected outcomes and environmental benefits of the proposed project. Share the findings with Yale to validate the design and align expectations. The method of verification for all outcomes will be approved by all team members.

Detailed Design Development: Work collaboratively to refine and finalize the detailed design, including energy systems, equipment selection, and integration. The preliminary project planning and phasing approach will be developed. The approach will be developed with end-user input to ensure constructability and smooth implementation.

Cost Estimation & Value Engineering: Collaboratively develop a detailed cost estimate for the project, considering the initial investment, operational costs, and long-term benefits. Conduct value engineering exercises to optimize the design while maintaining the desired outcomes.

50% Design Review: Agree on the scope and lump sum construction proposal, including NPV of desired outcomes and other critical KPIs to be established.

Milestones: Option to exit, ramp off will exist at every design milestone. We suggest three design milestones to get to 50%.

Contract Negotiation

Objective: Engage in open and transparent contract negotiations, ensuring that financial interests and risk-sharing mechanisms are aligned. Discuss fee structures and incentives that motivate both parties to achieve (or exceed) the desired outcomes.

Milestone: Contract execution

Construction & Implementation

Objective: Execute the construction phase according to the agreed-upon design, keeping Yale informed of progress through regular project updates. Proactively address any unforeseen challenges.

Milestones: Subcontractor selection approval; equipment selection approval; implementation planning and phasing approval, with a special focus on critical areas such as laboratories; progressive, final and shop drawings approval; sequence of operation approval.

Performance Monitoring

Objective: Establish a post-construction performance monitoring program to track the building's performance and ensure it aligns with the expected outcomes. Share monitoring results and analysis with Yale regularly.

Milestone: Monitoring & Verification KPI methodology approval

Testing & Commissioning:

Objective: Conduct rigorous testing and commissioning of all modified systems to ensure they meet the specified performance criteria.

Milestone: Stakeholders witness the testing process and provide feedback.

Handover & Training

Objective: Provide comprehensive training and documentation to the operating teams on the operation, maintenance, and management of the modified systems.

Milestone: Operators have the necessary knowledge to maximize the benefits of the project.

Risk Sharing & Alignment

Risk sharing and aligning interests between Yale and its selected partner are embedded in an outcome-based contract. As it currently stands, Yale bears all the risk, creating a potential misalignment of interests. Reorienting partner financial interests so they are tied to both inputs and outcomes builds a mutual interest in the successful attainment of project goals.

Risk sharing mechanisms do more than just align financial interests – they also promote innovation, a key ingredient for successful decarbonization initiatives. An outcome-based contract incentivizes not just cost-effective measures, but also creative solutions that can yield better out-comes for Yale. Typically, the construction industry lacks innovation because risk-sharing mechanisms do not exist and therefore firms do not have any incentive for creativity. This misalignment needs to be addressed if Yale is to benefit from co-developed, holistic, right-sized solutions that are continuously improved through design and construction – innovative solutions that not only reduce costs but also maximize outcomes.

By re-evaluating your contractual structure to focus on partnership dynamics, emphasize outcomes, and encourage risk sharing and accountability for results, Yale has a higher probability of reaching and possibly exceeding the outcomes you seek, maintaining your leadership position in the broader construction industry and within higher education.

Pre-Contract Milestones

This is a base set of pre-contract milestones, which can be adapted to Yale's specific needs and requirements. For a template list of all project milestones through implementation, please see Appendix D.

Yale / Ecosystem - Science Hill Energy Services Project

Pre-Contract Proposed Process

Team Organization
Alignment of Interest • Define roles & responsibilities for all parties • Clear understanding of stakeholder priorities • Define project objectives & KPIs
Document Management • Confirm Yale's document management requirements • Confirm document sharing best practices (naming conventions, shared space, etc.) • Confirm document formats (Agenda, Meeting Minutes, Action Log)
Initiating Collaborative Design Engineering
Review of the RFP vs the needs with stakeholders
Perform interviews with Yale's operation team
Confirm alignment on design 20% with Yale
Pre-Contract Design Engineering (Pre-Design)
Initiate Design 20%
20% Engineering to Yale - drawings & engineering narrative
Collaborative working session & comments on 20% engineering
Cost estimation first draft to Yale for comments (±25%)
Definition of alignment toward 50% engineering
50% engineering to Yale - drawings & engineering narrative
Cost estimation ±15% to Yale
Value engineering session #1
Review of pre-contract 50% engineering as required
Value engineering Session #2
50% detailed design acceptance by Yale
Pre-Contract Project Management
First draft schedule issued to Yale
Required permits & authorizations shared with Yale
Yale/Ecosystem Collaborative Working Session • Key yearly planned shutdowns shared by the • Downtime period discussion • Single point of failure discussion
Contractual Schedule Discussion • Review of the 50% design engineering schedule • Collaborative working session • Agreement on key project implementation milestones
Contractual Steps
Review of financials
Contractual negotiation
Contract signature
PO issuance date

5

Project Cost Structure

The following table presents the proposed cost structure as listed in the RFP. Additional information on our approach for the project as a whole is presented in the previous Project Agreement section.

Attachment D: Project Cost Structure

Phase	Fee Description	%
Pre-Design	See exhibit B document in Appendix E	
Design	Percentage of Estimated DAPC	10%
Procurement	Percentage of Estimated DAPC	2%
Construction	Percentage of Actual DAPC	7%
Performance Monitoring	Percentage of Actual DAPC	3%
Direct Mark-up	Percentage of Actual DAPC	10%
Total	**Sum of above**	**32%**

Appendix

Team CVs

André-Benoit Allard
Senior Project Director

As Senior Project Director, André-Benoit positions his teams for success, resulting in high-performing projects and satisfied clients. He acts as a point of contact for clients and equipment providers, overseeing the design of energy efficiency measures, implementation of plans and specifications, and construction.

André-Benoit is an internationally recognized design engineer. The extensive retrofit of the Montreal Biodome earned him the 2013 International ASHRAE Technology Award for exceptional engineering design. He is fascinated by the variety in each process and finds creative solutions based on his comprehensive experience with all project phases.

Representative Projects

Humber College (2021-ongoing)

Preliminary Phase Design Services

Detailed design study to decarbonize with a district energy and steam to hot water conversion project. Outcomes include reduced GHG emissions, integration of islanded buildings, improved O&M, energy and water use reduction.

Vassar College (2020 -2022)

Project Value: $11,850,000
Annual Savings: $905,000
Guaranteed Incentives: $1,850,000

Lighting upgrades, distributed heat recovery, decentralized chiller, chiller plant optimization, operating pressure reduction, ventilation optimization, controls optimization, air handling unit replacement, cooling system retrofit.

Massachusetts Trial Courts (DCAMM) (2019-2022)

Project Value: $4,304,716
Guaranteed Annual Savings: $236,898
Incentives: $372,760
Number of Buildings: 4

Lighting upgrade, lighting controls, premium efficiency motors and VFD, high-efficiency boiler replacement, chiller replacement, DDC control system, low flow water fixtures, plug load controllers.

DYS Connelly Youth Center (DCAMM) (2020)

Project Value: $5,625,575
Guaranteed Annual Savings: $49,809

Installation of biomass boiler, hot water and steam distribution piping upgrades, installation of variable frequency drives.

Experience

20 years

Education

- Bachelor of Mechanical Engineering, Sherbrooke University, 2001

Previous Functions

- 2003-2005: Process Engineer, Central Heat and Recovery, Smurfit-Stone
- 2002-2003: Coordinator, Jaakko Pöyry ABGS
- 2001: Project Management Intern, Baxter Corporation
- 2000: R&D Project Management Intern, Waterville TG

Brown University (2017-2021)

Project Value: $24,800,000
Guaranteed Annual Savings: $1,011,000
Guaranteed Incentives: $1,200,000
Number of Buildings: 37

Campus district heating loop conversion from high-temperature hot water to medium-temperature hot water, steam to hot water conversions, dedicated steam boiler, electric humidification, BAS upgrades.

AWARDS

★ **2021 SCUP Awards, Excellence in Planning, District or Campus Component**

Massachusetts Emergency Management Agency (MEMA) 2018-2020)

Project Value: $5,134,815
Annual Savings: $225,171
Incentives: $363,351
Number of Buildings: 1

AHU replacement, demand control ventilation, PV canopy, lighting upgrade, BAS upgrade, real-time metering, EV charging station, chilled water pumps and VFD, cooling tower, heat pumps, demand response and fire system replacement.

Barry Callebaut (2017-2018)

Project Value: $3,400,000
Guaranteed Annual Savings: $199,190
Guaranteed Incentives: $900,000

Heat recovery, installation of biomass boiler.

AWARDS

★ **2019 Innovative Energy Project of the Year - Canada Region, AEE**
★ **2019 Eureka Award, Ecotech Quebec**

Calgary Board of Education (2015-2018)

Project Value: $18,500,000
Guaranteed Annual Savings: $888,330
Number of Buildings: 102

Installation of centralized controls, optimization of existing systems, installation of ventilation systems, new domestic hot water network, lighting conversion.

Olympic Park (2015-2018)

Project Value: $22,754,425
Guaranteed Annual Savings: $1,296,476
Guaranteed Incentives: $680,000

Steam to hot water conversion of heating system, peak demand management, heat recovery, retrofit of chilled water system, controls upgrade, lighting conversion, recommissioning, heat pump replacement, ventilation optimization, building envelope improvement.

AWARDS

★ **2019 International Technology Award, ASHRAE**
★ **2018 Energy Project of the Year - Canada Region, AEE**

University of Quebec in Trois-Rivières (UQTR) (2012-2014)

Project Value: $6,336,326
Guaranteed Annual Savings: $412,703
Number of Buildings: 13

Heat recovery, installation of efficient boilers, conversion of the high-temperature hot water heating system to low temperature, optimization of chilled water systems, installation of energy-efficient hoods, ventilation optimization, humidification system optimization, efficient lighting, measurement, installation of a BTU meter.

AWARD

★ **2017 Energia Award, AQME**

Saint-Sacrement Hospital (2011-2014)

Project Value: $5,580,714
Guaranteed Annual Savings: $443,111
Area: 657,901 ft^2

Steam to hot water conversion, geothermal energy, optimization of heat pump system, steam system optimization, optimization of chilled water systems, ventilation optimization, efficient lighting, addition and optimization of centralized controls.

AWARDS

★ **2018 Technology Award, ASHRAE**
★ **2017 Wayne McLellan Award, Canadian Healthcare Engineering Society (CHES)**
★ **2017 Energia Award, AQME**

Enfant-Jesus Hospital (2011-2014)

Project Value: $11,963,478
Guaranteed Annual Savings: $636,802
Area: 1,009,719 ft^2

Steam to hot water conversion, geothermal energy, heat recovery, installation of efficient boilers, steam system optimization, cooling tower replacement, installation of stack economizers, optimization of heat pump system, humidification system optimization, ventilation optimization, fresh air preheating using solar energy, efficient lighting, recommissioning.

AWARDS

★ **2018 Technology Award, ASHRAE**
★ **2017 Wayne McLellan Award, Canadian Healthcare Engineering Society (CHES)**
★ **2017 Energia Award, AQME**

Niagara Health System (2010-2015)

Project Value: $10,998,263
Guaranteed Annual Savings: $1,200,000
Number of Buildings: 6
Reduction of GHG emissions: 3190 metric tons of CO_2

Steam to hot water conversion, heat recovery, optimization of boiler room equipment, installation of solar thermal collectors, installation of variable frequency drives, ventilation optimization, humidification system optimization, optimization of centralized controls.

Lakeridge Health (2010-2014)

Project Value: $25,000,000
Guaranteed Annual Savings: $1,460,000
Number of Buildings: 4

Steam to hot water conversion, cogeneration, steam system optimization, installation of solar thermal collectors, installation of high-efficiency heat pumps, installation of energy-efficient hoods, installation of static heat recovery loops, installation of variable frequency drives, chiller conversion, humidification decentralization, optimization of the domestic water heating systems, city water hookup modifications, efficient lighting, solar photovoltaic power generation, optimization of centralized controls, replacement of make-up air unit for OR and other critical hospital areas.

AWARDS

- ★ **2021 ASHRAE Technology Award, Existing Healthcare Facilities, Toronto Region**
- ★ **2021 Institutional Energy Management, Association of Energy Engineers, Canada**
- ★ **2017 Best Overall / Collaboration Award, Powerup Durham**
- ★ **2015 Top 15 Green Projects in Canada Clean50**
- ★ **2014 Environmental Achievement Award, Durham Environmental Advisory Committee**
- ★ **2013 Green Hospital of the Year, Ontario Hospital Association**

Haliburton Highlands Health Services (2010-2012)

Project Value: $2,000,000
Guaranteed Annual Savings: $185,800
Number of Buildings: 2

Geothermal energy, ventilation recommissioning, variable frequency drives, solar photovoltaic power generation, efficient lighting retrofit, optimization of controls.

Hauts-Bois-de-l'Outaouais School Board (2010-2012)

Project Value: $7,655,102
Guaranteed Annual Savings: $398,000
Number of Buildings: 25

Lighting conversion, boiler replacement, heat recovery, geothermal energy, installation of electric boilers, biomass heating, ventilation control, secondary heat plant, insulation of domestic hot water network, heat pump.

Design

Montreal Biodome – Space For Life (2009-2010)

Project Value: $9,627,753
Guaranteed Annual Savings: $1,000,000
Number of Buildings: 3

Geothermal energy, heat recovery, off-peak heating, optimization of heating systems, optimization of chilled water systems, installation of variable frequency drives, ventilation optimization, efficient lighting.

AWARDS

- ★ **2015 International Energy Project of the Year, AEE**
- ★ **2013 International Technology Award, ASHRAE**
- ★ **2012 Pilier d'Or, AGPI**
- ★ **2012 Sustainable Communities Award, FCM**
- ★ **2011 Energia Award, AQME**
- ★ **2011 Honourable Mention, Innovation Award, Contech**

J.P. Drouin

Project Executive

J.P. Drouin is passionate about finding creative and impactful solutions for his clients' complex energy ecosystems and is committed to delivering results. He is an engineer who specializes in transformational energy measures and deep building retrofits such as steam to hot water conversions, heat recovery chiller applications, district energy networks, and combined heat and power. He helps building owners develop and implement their energy vision by reducing energy consumption and GHG emissions, facilitating operation and maintenance, renewing assets, or improving occupant comfort.

Representative Projects

Tufts University (2021-ongoing)

Project Value: $5,000,000
GHG reduction measures that are NPV-positive.

Tufts University (2020)

Development of a Master Plan for a campus district energy system, cumulating in net-zero carbon heating. Conversion of building to low-temperature heating and integration of heat pumps.

ENGIE - The Ohio State University (2017– ongoing)

Project Value: $84,000,000
Energy Bill Reduction: 30%
Number of Buildings: 40

Ventilation deep retrofit and optimization, heat recovery systems, heating and cooling systems deep retrofit and optimization, lighting system upgrades, centralized controls modernization, renewable and distributed energy resource, building envelope upgrades.

Vassar College (2020 -2022)

Project Value: $11,850,000
Annual Savings: $905,000
Guaranteed Incentives: $1,850,000

Lighting upgrades, distributed heat recovery, decentralized chiller, chiller plant optimization, operating pressure reduction, ventilation optimization, controls optimization, air handling unit replacement, cooling system retrofit.

Vassar College (2019)

Preliminary study and in-depth analysis to define the path to a net-zero campus, including district network
and building-level technologies and energy source analysis.

Experience

16 years

Education

- Bachelor of Mechanical Engineering, McGill University, 2006

Qualifications

- Certified Energy Manager
- Distributed Generation Certified Professional
- Engineer, Ordre des ingénieurs du Québec (Quebec Order of Engineers)

Awards

- International Young Energy Professional of the Year Award, Association of Energy Engineers, 2016

Brown University (2017-2020)

Project Value: $24,800,000
Guaranteed Annual Savings: $1,011,000
Guaranteed Incentives: $1,200,000
Number of Buildings: 37

Campus district heating loop conversion from high-temperature hot water to medium-temperature hot water, steam to hot water conversions, dedicated steam boiler, electric humidification, BAS upgrades.

AWARDS

★ **2021 SCUP Awards, Excellence in Planning, District or Campus Component**

Mineola Public Schools (2018-2020)

Project Value: $7,268,590
Guaranteed Annual Savings: $373,390
Number of Buildings: 8

Interior and exterior lighting upgrade, steam to hot water conversion, new unit ventilator, hot water boiler upgrade, controls upgrade, oil to gas heating conversion, computer energy manager, solar photovoltaics.

Rockland Community College (2016-2019)

Project Value: $8,440,000
Guaranteed Annual Savings: $518,000
Number of Buildings: 9

Interior and exterior lighting upgrade, boiler plant upgrade, integrated building management system, variable speed drives, automatic seasonal changeover, water efficiency, fresh air intake improvement, computer load management, combined heat and power generation, installation of high-efficiency centrifugal chiller, installation of natural gas engine driven chiller.

University of California - Davis (2017-2018)

Energy Master Plan Peer Review

Determining the best path to achieve the university's 2025 carbon neutrality goal. Solutions considered included steam to hot water conversion, heat recovery chillers, geothermal heating and cooling, air source heat pumps, and solar PV.

Barry Callebaut (2017-2018)

Project Value: $3,400,000
Guaranteed Annual Savings: $199,190
Guaranteed Incentives: $900,000

Heat recovery, installation of biomass boiler.

AWARD

★ **2019 Innovative Energy Project of the Year - Canada Region, AEE**
★ **2019 Eureka Award, Ecotech Quebec**

Adelphi University (2015-2016)

Project Value: $13,500,000
Guaranteed Annual Savings: $1,600,000

CHP plant, boiler replacement, ventilation optimization.

AWARD

★ **2019 Energy Project of the Year Award - Long Island Chapter, AEE**

Jewish General Hospital – Phase II (2013-2014)

Project Value: $7,062,043
Guaranteed Annual Savings: $369,884
Area: 1,199,193 ft^2

Open-source geothermal energy, heat recovery from the open-source geothermal system, laboratory exhausts and stack economizer, steam to hot water heating conversion, system network optimization.

BronxCare Hospital Center (2013-2014)

Project Value: $3,610,000
Area: 447,195 ft^2

Construction of mechanical room, chiller installation, new electric service, installation of variable flow pumping system, rebuilding existing cooling tower.

New York City School Construction Authority (2012-2014)

Project Value: $8,591,000
Guaranteed Annual Savings: $146,300

Comprehensive energy audits and lighting upgrades (part of Phase 1 of the Department of Education's $780M comprehensive energy conservation and upgrade program).

Mount Sinai Brooklyn – Kings Highway Division, Brooklyn, New York (2011-2012)

Project Value: $4,100,000
Annual Savings: $600,000
Number of Buildings: 4

Cogeneration, steam to hot water heating conversion, lighting retrofit, controls upgrade, installation of variable frequency drives, water conservation measures.

AWARDS

- ★ **2015 EBie Award**
- ★ **2014 Regional Energy Project of the Year, AEE**
- ★ **2013 NYC Energy Project of the Year, AEE**

Maisonneuve-Rosemont Hospital (2013-2015)

Project Value: $7,241,783
Guaranteed Annual Savings: $530,000
Area: 1,482,137 ft^2

Geothermal energy, heat recovery, steam to hot water conversion, heat pump installation, efficient lighting, boiler replacement, peak demand management.

Laurentides Health Center (2010-2012)

Project Value: $12,815,230
Guaranteed Annual Savings: $1,036,227
Number of Buildings: 3

Geothermal energy, heat recovery, biomass, installation of efficient boilers, steam system optimization, installation of energy-efficient hoods, recommissioning of existing electric boilers, efficient lighting.

Samares School Board – Phase III (2009-2011)

Project Value: $5,561,690
Guaranteed Annual Savings: $422,000
Number of Buildings: 36

Geothermal system, biomass heating, lighting conversion, centralized controls, efficient domestic hot water heating, thermal storage, installation of electric boilers, and meters merging.

Bob Mancini

Client Liaison

A quintessential sales professional, Bob joined Ecosystem in 2016 to spearhead continued growth in New England. Through a discovery process that is rooted in developing win-win outcomes, he consistently helps clients achieve their goals, satisfy needs, and solve problems by mapping them against Ecosystem's core competencies. Bob's exceptional communication skills, coupled with an innate situational awareness and unquestionable integrity, helps to build lasting, mutually beneficial relationships. Bob's extensive experience in both the environmental and energy industries, combined with his engineering education, adds significant value to clients focused on energy, operating expense, and greenhouse gas reduction. High standards, a glass-half-full mindset, a practice of continuous self-improvement, and the desire to contribute to the greater good make working with Bob a positive experience.

Bob has delivered over $250M in contracted revenue working with commercial and industrial clients, mostly serving the Higher Education and Healthcare sectors.

Representative Projects

Brown University Jewelry District (2022-2023)

Detailed Feasibility Study & Action Plan
Analyzed potential pathways, including standalone solutions, a decarbonized central heating and cooling plant, and a fifth-generation mitigated loop with distributed low-carbon heating technologies.

Vassar College (2020 -2022)

Project Value: $11,850,000
Annual Savings: $905,000
Guaranteed Incentives: $1,850,000
Lighting upgrades, distributed heat recovery, decentralized chiller, chiller plant, ventilation and controls optimization, operating pressure reduction, air handling unit replacement, cooling system retrofit.

Tufts University (2021-ongoing)

Project Value: $5,000,000
GHG reduction measures that are NPV-positive.

Tufts University (2020)

Development of a Master Plan for a campus district energy system, cumulating in net-zero carbon heating. Conversion of building to low-temperature heating and integration of heat pumps.

Experience

33 years

Education

- B.S. Civil and Environmental Engineering, University of Rhode Island
- Certified Energy Manager (C.E.M.) 2013

Previous Functions

- 2013-2015: Sr. Director, Strategic Sales East Coast, Enlighted
- 2004-2013: Sr. Business Development Manager, EnerNOC
- 1993-2004: Sr. Advisor, Triumvirate Environmental

Brown University (2017-2020)

Project Value: $24,800,000
Guaranteed Annual Savings: $1,011,000
Guaranteed Incentives: $1,200,000
Number of Buildings: 37

Campus district heating loop conversion from high-temperature hot water to medium-temperature hot water, steam to hot water conversions, dedicated steam boiler, electric humidification, BAS upgrades.

AWARDS

★ **2021 SCUP Awards, Excellence in Planning, District or Campus Component**

Vassar College (2019)

Preliminary study and in-depth analysis to define the path to a net-zero campus, including district network and building-level technologies and energy source analysis.

Harvard Faculty of Arts & Sciences (2017-2018)

Preliminary design and detailed study using decentralized heat pumps within the district energy steam network.

David Bonneau

Lead Design Engineer

Early in his career, David Bonneau worked as a Computer Aided Design (CAD) specialist for several fields including aeronautics, heavy transport, and the plastics industry.

David is an efficient engineer with exceptional analytical abilities. He focuses his efforts on delivering high-performance projects that meet his client's needs within the established timelines.

Representative Projects

San Diego Padres - Petco Park Stadium (2022-2023)

Project Value: $5,865,000
Guaranteed Annual Savings: $1,000,000

Installation of a new chiller plant, advanced control optimization

Côte-Nord Integrated Health Center (2021-ongoing)

Project Value: $10,504,490
Guaranteed Annual Savings: $986,044
Guaranteed Incentives: $3,822,122
Number of Buildings: 8

Steam-to-hot-water conversion, boiler rooms retrofit, ventilation optimization, heat recovery, LED lighting conversion, controls optimization, aerothermal energy.

ENGIE - The Ohio State University (2017– ongoing)

Project Value: $84,000,000
Energy Bill Reduction: 30%
Number of Buildings: 40

Ventilation deep retrofit and optimization, heat recovery systems, heating and cooling systems deep retrofit and optimization, lighting system upgrades, centralized controls modernization, renewable and distributed energy resource, building envelope upgrades.

Scripps Mercy Hospital - Detailed Study (2021-2022)

Resiliency-focused generation and energy efficiency project including microgrid study for solar batteries and combined heat and power. Steam to hot water conversion and heat recovery chiller

Stuyvesant Town – Peter Cooper Village (2017–2022)

Project Value: $19,284,000
Guaranteed Annual Savings: $2,625,000
Guaranteed Incentives: $1,382,000

Combined heat and power units, high-efficiency boilers, steam peak optimization, electricity resiliency and redundancy, electrical systems upgrade, new gas service, centralized controls for CHP plant.

Experience

14 years

Education

- Bachelor of Mechanical Engineering, Laval University, 2008

Qualifications

- Engineer, Ordre des ingénieurs du Québec (Quebec Order of Engineers)

Previous Functions

- 2008-2009: CAD Specialist, Creaform.
- 2006: Mechanical Engineering Intern, Usimax.

Saint-François d'Assise Hospital (2014-2017)

Project Value: $9,398,644
Guaranteed Annual Savings: $523,036
Area: 756,703 ft^2

Aerothermal energy and heat recovery, steam to hot water conversion, optimization of chilled water network and ventilation, installation of intelligent hoods, optimization of domestic hot water production, lighting conversion, laundry optimization, steam system optimization, piping replacement.

AWARD

★ **2017 Energia Award, AQME**

Pays-Des-Bleuets School Board (2016)

Project Value: $740,000

Cooling tower replacement

Outaouais Health Center (2013-2014)

Project Value: $4,288,932
Guaranteed Annual Savings: $228,596
Number of Buildings: 3

Geothermal energy, heat recovery, steam to hot water heating conversion, domestic hot water heating optimization, cooling system optimization, optimization of centralized controls, efficient lighting, ventilation optimization, off-peak electric heating.

Bell / SNC Lavalin – 930 Aiguillon St., Quebec City (2012)

Project Value: $477,256
Guaranteed Annual Savings: $120,300

Heat recovery, ventilation optimization, recommissioning.

Laval University Hospital Center (CHUL) (2011-2015)

Project Value: $21,190,158
Guaranteed Annual Savings: $2,106,000
Area: 1,121,599 ft^2

Steam to hot water conversion, geothermal energy, heat recovery, steam system optimization, optimization of chilled water systems, installation of energy-efficient hoods, conversion of kitchen equipment, decentralization of sterilization equipment, ventilation optimization, ventilation control, fresh air preheating using solar energy, efficient lighting, optimization of centralized controls.

AWARDS

★ **2018 Technology Honorable Mention, ASHRAE**
★ **2017 Wayne McClellan Award, CHES**
★ **2017 Energia Award, AQME**

Vieille-Capitale Health Center (2011-2014)

Project Value: $6,650,074
Guaranteed Annual Savings: $565,000
Number of Buildings: 3

Heat recovery, geothermal energy, installation of efficient boilers, steam network optimization, hot water system optimization, installation of energy efficient hoods, off-peak water heating, lighting conversion.

Pays-Des-Bleuets School Board (2010-2011)

Project Value: $7,862,040
Guaranteed Annual Savings: $481,101
Number of Buildings: 15

Geothermal energy, heat recovery, aerothermal energy, biomass, efficient boiler installation, off-peak hot water heating, heating system conversion, off-peak hot water heating, replacing of ventilation units, electrical inlet repair, peak electric demand control, efficient lighting.

Simon Lessard

Lead Design Engineer

Known for his exceptional technical expertise, Simon has developed engineering studies and designs that have contributed significantly to successful multi-million-dollar projects. He is Ecosystem's resident expert in highly complex networks as well as ventilation and cooling systems.

Simon understands the potential and limitations of each building and delivers creative solutions even when time is limited. Because he has worked in many sectors across the US and Canada, he efficiently evaluates situations, preventing errors in project design and correcting systematic problems.

Dedicated to meeting clients' needs, Simon develops relationships with providers that allow him to obtain the best equipment and prices. He enjoys working in teams and provides invaluable technical support and resources. Since he approves the financial data on each project, he is knowledgeable about savings and performance verification as well as incentives.

Representative Projects

University of Toronto (2022-ongoing)

Detailed engineering and design for U of T's Project LEAP. This project will transform the generation, distribution, and consumption of energy at the St. George campus without impacting operational expenses and reducing GHG emissions significantly.

Mineola Public Schools (2018-2020)

Project Value: $7,268,590
Guaranteed Annual Savings: $373,390
Number of Buildings: 8

Interior and exterior lighting upgrade, steam to hot water conversion, new unit ventilator, hot water boiler upgrade, controls upgrade, oil to gas heating conversion, computer energy manager, solar photovoltaics.

ENGIE - The Ohio State University (2017 - ongoing)

Project Value:: $84,000,000
Energy Bill Reduction: 30%
Number of Buildings: 40

Ventilation deep retrofit and optimization, heat recovery systems, heating and cooling systems deep retrofit and optimization, lighting system upgrades, centralized controls modernization, renewable and distributed energy resource, building envelope upgrades.

Experience

21 Years

Education

- Bachelor of Science in Mechanical Engineering, Sherbrooke University, 2001
- Diploma in Natural Sciences, Thetford College, 1997
- General Health and Safety on Construction Sites, ASP Construction, 2001
- Introduction to Financial Statements, Sherbrooke University, 2000

Qualifications

- Certified Energy Manager
- Certified Measurement and Verification Professional
- Engineer, Ordre des ingénieurs du Québec (Quebec Order of Engineers)
- P.Eng., Professional Engineers Ontario

Previous Functions

- 2000: Production Engineering Intern, Teraxion
- 2000: Product Engineering Intern, Nortel Networks

DePauw University (2017-2021)

Campus Energy Master Plan and Core Project
Project Value: $14,758,000

Masterplan to achieve a minimum of 25% reduction in energy costs over three years. The Plan identifies immediate infrastructure initiatives that will lower energy use, reduce energy waste, decrease energy costs, cut greenhouse gas emissions, and address critical deferred maintenance needs. Measures in the Plan include steam to hot water conversion and centralization of the chilled water network. Work completed by Ecosystem includes a new campus-wide underground heating and cooling network, replaced boilers and cooling towers, LED lighting upgrades, and controls optimization.

AWARD

★ **2021 IDEA Innovations Awards - Honorable Mention**

Rockland Community College (2016-2019)

Project Value: $8,440,000
Guaranteed Annual Savings: $518,000
Number of Buildings: 9

Interior and exterior lighting upgrade, boiler plant upgrade, integrated building management system, variable speed drives, automatic seasonal changeover, water efficiency, fresh air intake improvement, computer load management, combined heat and power generation, installation of high-efficiency centrifugal chiller, installation of natural gas engine driven chiller.

Enfant-Jésus Hospital (2011-2014)

Project Value: $11,963,478
Guaranteed Annual Savings: $636,802
Area: 1,009,719 ft^2

Steam to hot water conversion, geothermal energy, heat recovery, installation of efficient boilers, steam system optimization, cooling tower replacement, installation of stack economizers, optimization of heat pump system, humidification system optimization, ventilation optimization, fresh air preheating using solar energy, efficient lighting, recommissioning.

AWARDS

★ **2018 Technology Award, ASHRAE**
★ **2017 Wayne McLellan Award, Canadian Healthcare Engineering Society (CHES)**
★ **2017 Energia Award, AQME**

Sherbrooke Regional School Board (2013-2014)

Project Value: $7,879,109
Guaranteed Annual Savings: $660,738
Number of Buildings: 26

Aerothermal energy, heat recovery, heating system steam to hot water conversion, adding and optimizing centralized controls, ventilation optimization, geothermal energy, efficient boiler installation, hot water heater installation, off-peak hot water heating, coil conversion, boiler replacement, pump optimization, steam network optimization, power factor correction.

Samares School Board – Phase IV (2011-2012)

Project Value: $2,484,041
Guaranteed Annual Savings: $144,875
Number of Buildings: 32

Geothermal energy, heat recovery, biomass, installation of thermal storage units, installation of solar walls, efficient lighting.

Saint-Sacrement Hospital (2011-2014)

Project Value: $5,580,714
Guaranteed Annual Savings: $443,111
Area: 657,901 ft^2

Heating system steam to hot water conversion, geothermal energy, heat pump network optimization, steam network optimization, chilled water system optimization, ventilation optimization, efficient lighting, adding and optimizing centralized controls.

AWARDS

★ **2018 Technology Award, ASHRAE**
★ **2017 Wayne McLellan Award, Canadian Healthcare Engineering Society (CHES)**
★ **2017 Energia Award, AQME**

La Tuque Hospital (2011-2014)

Project Value: $3,285,663
Guaranteed Annual Savings: $239,000
Area: 75,719 ft^2

Heat recovery, pre-heating of domestic hot water and laundry, lighting retrofit, biomass, hydroelectric turbine.

Laurentides Health Center (2010-2012)

Project Value: $12,815,230
Guaranteed Annual Savings: $1,036,227
Number of Buildings: 3

Geothermal energy, heat recovery, biomass, installation of efficient boilers, steam system optimization, installation of energy-efficient hoods, recommissioning of existing electric boilers, efficient lighting.

Montreal Neurological Hospital – Phase I & II (2005-2010)

Project Value: $7,565,920
Guaranteed Annual Savings: $982,000
Area: 276,237 ft^2

Steam to hot water conversion, heat recovery, off-peak heating, optimization of the hot water system, installation of variable frequency drives, installation of humidification system equipment, addition and optimization of centralized controls, installation of a cooling system, linking of heating systems, efficient lighting.

Jewish General Hospital – Phase I (2006-2007)

Project Value: $1,600,000
Guaranteed Annual Savings: $417,000
Area: 1,199,193 ft^2

Off-peak mode electric boiler, heat recovery, low-temperature heating network, replacement of coils.

Scarborough Grace Hospital (2006)

Project Value: $1,885,000
Guaranteed Annual Savings: $302,000
Area: 439,996 ft^2

Heat recovery in the summer with two (2) new 125-ton heat recovery chillers, dismantlement of 300 HP steam boiler, installation of new 150 HP bi-fuel cast iron hot water boiler, installation of new low-temperature heat pumps, installation of chilled water pumps, installation of VFDs.

St. Michael's Hospital, Toronto (2004-2005)

Project Value: $7,900,000
Guaranteed Annual Savings: $1,900,000
Area: 1,388,544 ft^2

Steam to hot water conversion, heat recovery, optimization of the domestic water heating systems, ventilation optimization, humidification system optimization, optimization of sterilization equipment, efficient lighting.

AWARDS

★ **2006 Green Health Care Award, OHA**
★ **2006 National Health Care Management Award, CCHL & OEE**

Design

Adelphi University (2015-2016)

Project Value: $13,500,000
Guaranteed Annual Savings: $1,600,000

CHP plant installation, boiler replacement, ventilation optimization.

AWARDS

★ **2019 Energy Project of the Year Award - Long Island Chapter, AEE**

Maisonneuve-Rosemont Hospital (2013-2015)

Project Value: $7,241,783
Guaranteed Annual Savings: $530,000
Area: 1,482,137 ft^2

Geothermal energy, heat recovery, steam to hot water conversion, heat pump installation, efficient lighting, boiler replacement, peak demand management.

Samares School Board – Phase IV (2011-2012)

Project Value: $2,484,041
Guaranteed Annual Savings: $144,875
Number of Buildings: 32

Geothermal energy, heat recovery, biomass, installation of thermal storage units, installation of solar walls, efficient lighting.

Marguerite-Bourgeoys School Board (2003-2006)

Project Value: $8,000,000
Guaranteed Annual Savings: $1,300,000
Number of Buildings: 17

Heat recovery with thermal pumps, boiler replacement, chillers and cooling towers with high efficiency, reliable new equipment, air conditioning system optimization, lighting conversion for gymnasiums.

Beauceville Hospital Center (2004-2005)

Project Value: $1,580,000
Guaranteed Annual Savings: $238,000
Area: 246,927 ft^2

Steam to hot water conversion, heat recovery, steam system optimization, off-peak heating, humidification system conversion, optimization of the domestic water heating systems.

Harricana School Board (2010-2011)

Project Value: $6,822,412
Guaranteed Annual Savings: $324,781
Number of Buildings: 14

Lighting conversion, centralized controls, geothermal system, heat recovery, centralized heating systems optimization, chiller removal, ventilation optimization, installation of a hot water boiler plant, centralization of domestic hot water production, thermal storage, electric boiler control optimization.

Montreal Neurological Hospital – Phase I & II (2005-2010)

Project Value: $7,565,920
Guaranteed Annual Savings: $982,000
Area: 276,237 ft^2

Steam to hot water conversion, heat recovery, off-peak heating, optimization of the hot water system, installation of variable frequency drives, installation of humidification system equipment, addition and optimization of centralized controls, installation of a cooling system, linking of heating systems, efficient lighting.

Montreal General Hospital – Phase I & II (2006-2009)

Project Value: $9,564,000
Guaranteed Annual Savings: $1,500,000
Area: 913,253 ft^2

Steam to hot water conversion, heat recovery, installation of efficient boilers, installation of stack economizers, off-peak heating, combining heating systems, installation of heating systems, conversion of coils, electrical connections.

Douglas Institute (2006-2008)

Project Value: $5,000,000
Guaranteed Annual Savings: $650,000
Area: 678,655 ft^2

Heat recovery, heating conversion, steam system decentralization, off-peak heating, optimization of the domestic water heating systems, installation of humidification system equipment, power factor correction, replacement of ventilation units, efficient lighting.

City of Lévis (2004-2005)

Project Value: $3,675,000
Guaranteed Annual Savings: $625,000
Number of Buildings: 18

Installation of efficient boilers, optimization of heating systems, optimization of chilled water systems, optimization of the domestic water heating systems, installation of humidification system equipment, optimization of pool heating system, efficient lighting, installation of centralized controls.

Max Lamirande

Senior Project Engineer

Having been responsible for project development in the New York City area, Max is now spearheading Ecosystem's growth in California. He is responsible for building relationships with our clients on both coasts, qualifying opportunities, and figuring out what value we can bring to their projects.

As part of the Ecosystem project development team, Max has worked on many different types of projects and has been exposed to a wide range of innovative solutions. He collaborates with his colleagues across the company, exchanging knowledge and information.

Experience

11 years

Education

- Bachelor of Mechanical Engineering, ETS - University of Quebec, 2014

Representative Projects

San Diego Padres - Petco Park Stadium (2022-2023)

Project Value: $5,865,000
Guaranteed Annual Savings: $1,000,000

Installation of a new chiller plant, advanced control optimization

Scripps Mercy Hospital (2021-2022)

Detailed Study

Resiliency-focused generation and energy efficiency project including microgrid study for solar batteries and combined heat and power. Steam to hot water conversion and heat recovery chiller.

International Tailoring Company Building (2021 – 2023)

Project Value: $7,700,000
Incentives: $1,650,000
GHG Reduction: 80% of onsite emissions

Heat recovery, air-source heat pump, condensing boiler system, adiabatic dry cooler, hybrid water-cooled heat pimps. This project will achieve full Local Law 97 compliance through 2050, avoiding any potential fines.

Stuyvesant Town – Peter Cooper Village - Phase II (2020-2024)

Project Value: $64,850,000
Guaranteed Annual Savings: $9,600,000

Combined heat and power units, high efficiency boilers, disconnection from central steam network, new steam and hot water district heating network installation

Stuyvesant Town – Peter Cooper Village (2017-2022)

Project Value: $19,284,000
Guaranteed Annual Savings: $2,625,000
Guaranteed Incentives: $1,382,000

Combined heat and power units, high-efficiency boilers, steam peak optimization, electricity resiliency and redundancy, electrical systems upgrade, new gas service, centralized controls for CHP plant.

21 Clark Street (2018-2019)

Project Value: $3,500,000

Development, design, and construction support for a new boiler and chiller plant in a residential building converting to assisted living.

University of California - Davis (2017-2018)

Energy Master Plan Peer Review

Determining the best path to achieve the university's 2025 carbon neutrality goal. Solutions considered included steam to hot water conversion, heat recovery chillers, geothermal heating and cooling, air source heat pumps, and solar PV.

Estee Lauder Study (2016-2017)

Air conditioning and water conservation study for the company's Long Island, NY, manufacturing hub.

Brooklyn Hospital Center (2015-2016)

Design and construction management for chiller replacement and cooling system optimization.

Adelphi University (2015-2016)

Project Value: $13,500,000 • **Guaranteed Annual Savings:** $1,600,000

CHP plant, boiler replacement, ventilation optimization.

AWARD

★ **2019 Energy Project of the Year Award - Long Island Chapter, AEE**

St. Luke's Hospital (2015)

Project Value: $31,918,000
Incentives: $2,604,000

York College - DASNY (2014)

Detailed Feasibility Study

Control systems upgrade for VFDs and hybrid pneumatic-electronic control system.

Lucas Taub, EIT, CEM

Project Engineer

Lucas brings insight developed through experience in both design and construction to ensure that the transition between project phases is smooth and that no details are overlooked. Inspired by the quest of efficiency, Lucas is motivated to integrate newer, high-efficiency systems into existing infrastructure to achieve energy and cost savings, while eliminating excess in the construction process.

He takes pride in making measured, informed decisions, and steering projects with control and a calm persona. His areas of expertise include heat pumps, ventilation and heat recovery, cogeneration system, hydronic distribution systems, and solar PV arrays.

Previous Experience

North Shore Central School District (2019-2022)

Project Value: $7,200,000
Guaranteed Annual Savings: $397,000
Incentives: $52,000
Number of Buildings: 7

Interior lighting, exterior lighting, heating network optimization, building envelope improvements, DDC controls optimization, plug load management, addition of air-conditioning, solar PV.

Glen Cove City School District (2021-2022)

Project Value: $6,220,238
Guaranteed Annual Savings: $21,100
Incentives: $405,659
Number of Buildings: 9

Solar PV, lighting upgrades, boiler upgrades, VFDs and motor replacement, ventilation upgrades, BMS & controls upgrades, computer energy manager, plug load managers, envelope and insulation improvements.

Stuyvesant Town – Peter Cooper Village (2017-2022)

Project Value: $19,284,000
Guaranteed Annual Savings: $2,625,000
Guaranteed Incentives: $1,382,000

Combined heat and power units, high-efficiency boilers, steam peak optimization, electricity resiliency and redundancy, electrical systems upgrade, new gas service, centralized controls for CHP plant.

21 Clark Street (2017-2018)

Project Value: $3,500,000

Development, design, and construction support for a new boiler and chiller plant in a residential building converting to assisted living.

Experience

8 years

Education

- Bachelor of Science, Chemical Engineering, Washington University in St. Louis, 2016
- Masters of Engineering, Mechanical Engineering, Washington University in St. Louis, 2017

Qualifications

- Engineer in Training (EIT)
- Certified Energy Manager (CEM)
- LEED Green Associate

Previous Functions

- 2016: Energy Analyst, Energy Resources Group, Inc.
- 2015: Mechanical Engineering Intern, AeroValve, LLC.
- 2014: Research Assistant, Columbia University

Mineola Public Schools (2018-2020)

Project Value: $7,268,590
Guaranteed Annual Savings: $373,390
Number of Buildings: 8

Interior and exterior lighting upgrade, steam to hot water conversion, new unit ventilator, hot water boiler upgrade, controls upgrade, oil to gas heating conversion, computer energy manager, solar photovoltaics.

Gabrielle Turcot
Project Engineer

Gabrielle has completed her Ph.D. in Mechanical Engineering in 2022. In parallel to her studies, she held various academic and industry positions (university lecturer, process engineer, physics teacher) related to mechanical engineering and metallic materials.

Since her recent hiring at Ecosystem, she has been involved in a preliminary study for the implementation of a decarbonization project on the Brown University campus.

Gabrielle is a very clever, promising, and talented engineer who already demonstrates an excellent spirit of collaboration, both with colleagues and other project stakeholders. She is also very motivated to take part in the energy transition and contribute to GHG reduction.

Relevant Projects Ecosystem Project

Brown University - Graduate Center (2022-2023)

Preliminary Study for a decarbonization project

Academic Projects

Ph.D. Thesis (2022)

Development of a novel inverse methodology for the extraction of elasto-plastic properties of metals using spherical instrumented indentation

Final Year Project (2017)

Conception of an ultra-fast metallic 3D printer

Final Year Project (2015)

Corrosion analysis on a delivery truck structural part

Experience

4 years

Education

- Ph.D. in Mechanical Engineering, Polytechnique Montreal, 2022
- Bachelor of Mechanical Engineering, Polytechnique Montreal, 2017

Qualifications

- Engineer, Ordre des ingénieurs du Québec (Quebec Order of Engineers)

Previous Functions

- Physics Teacher, Andre-Grasset College, 2022
- Process Engineer, Rolls-Royce Canada Montreal, 2021-2022
- Lecturer in Mechanical Engineering, Polytechnique Montreal, 2015-2021

Awards & Scholarships

- Nomination for Best Thesis of the Year, Polytechnique Montreal 2022
- Bronze Award for Scientific Poster, 6th International Indentation Workshop, Sapporo, Japan, 2018
- Bachelors' Degree Distinction for Excellent Academic Results, Polytechnique Montreal, 2017
- Introduction to Research Scholarship (UPIR), Polytechnique Montreal, 2015
- Undergraduate NSERC Research Scholarship, Polytechnique Montreal, 2015

Kevin Fortin

Construction Director

Bringing his experience as a Construction Manager for large-scale energy performance projects to his current role as Director of Operations, Kevin matches critical technical resources to projects and teams that deliver guaranteed results. He tracks the company's key performance indicators, keeps projects on course for achievement, and coordinates activities for operational efficiency and continuous improvement.

Kevin is pragmatic, meticulous, and organized. Those who work with him appreciate his patience and strong communication skills. Known for his ability to take a 360-degree perspective, he provides solutions in a variety of areas, including corporate operations, team structure, organization of corporate resources, and legal issues. He is passionate about developing every team's leadership and autonomy to support growth and development.

Representative Projects/ Construction Management

International Tailoring Company Building (2021-2023)

Project Value: $7,700,000
Incentives: $1,650,000
GHG Reduction: 80% of onsite emissions

Heat recovery, air-source heat pump, condensing boiler system, adiabatic dry cooler & hybrid water-cooled heat pumps.

Bedford Central School District (2019-2023)

Project Value: $8,200,000
Guaranteed Annual Savings: $559,000
Incentives: $555,000
Number of Buildings: 8

Interior lighting upgrade, exterior lighting upgrade, steam-to-hot-water conversion, heat pumps, controls upgrade.

Glen Cove City School District (2021-2022)

Project Value: $7,856,000
Guaranteed Annual Savings: $470,332
Incentives: $122,503
Number of Buildings: 9

Solar PV, lighting upgrades, boiler upgrades, VFDs and motor replacement, ventilation upgrades, BMS & controls upgrades, computer energy manager, plug load managers, envelope and insulation improvements.

Experience

15 years

Education

- Master of Business Administration (MBA), International Emphasis, Laval University, Quebec, Kennesaw State University, Kennesaw GA, 2009
- Bachelor of Mechanical Engineering, Laval University, Quebec, 2007

Licences & Qualifications

- P.Eng., Professional Engineers Ontario
- Engineer, Ordre des ingénieurs du Québec (Quebec Order of Engineers)

Previous Functions

- 2009: Graduate Research Assistant, Michael J. Coles College of Business, Kennesaw State University, Kennesaw GA
- 2007: Graduate Research Assistant, Mechanical Engineering Design Office, Laval University, Quebec
- 2006: Project Manager, Ressorts Liberté, Montmagny
- 2005: Process Validation Technician, Stryker Medical LP, L'Islet

City of Toronto - City Waterfront Building (2020-2022)

Project Value: $3,084,973
Annual Savings: $95,068
Incentives: $850,000

Lake-based hydrothermal system, BAS replacement, RCx, & standard efficiency measures.

City of Toronto - EMS Headquarters (2020-2022)

Project Value: $5,163,000
Annual Savings: $289,000
Incentives: $100,000

Geothermal heating and cooling, heat recovery including garage ventilation heat recovery, air-source heat pumps, LED lighting, heating and cooling systems upgrade, controls optimization, solar PV

North Shore Central School District (2019-2022)

Project Value: $7,200,000
Guaranteed Annual Savings: $397,000
Incentives: $52,000
Number of Buildings: 7

Interior lighting, exterior lighting, heating network optimization, building envelope improvements, DDC controls optimization, plug load management, addition of air-conditioning, solar PV.

Massachusetts Trial Courts (DCAMM) (2019-2022)

Project Value: $4,304,716
Guaranteed Annual Savings: $236,898
Incentives: $372,760
Number of Buildings: 4

Lighting upgrade, lighting controls, premium-efficiency motors and VFD, high-efficiency boiler replacement, chiller replacement, DDC control system, low flow water fixtures, plug load controllers.

Toronto Community Housing Corporation (2018-2021)

Project Value: $29,327,662
Incentives: $4,774,000
Number of Buildings: 24

Installation of cogeneration units, replacement of generators with natural gas units.

Toronto Community Housing Corporation – Kendleton Drive (2019-2020)

Project Value: $1,945,000

Replacement of 785 radiators and boiler optimization /controls.

Slovak Village (2019-2020)

Project Value: $1,440,000
Guaranteed Annual Savings: $24,559
Incentives: $176,985

Window replacement, MAU replacement, boiler replacement, LED lighting conversion.

Toronto Community Housing / The Atmospheric Fund (2019-2020)

Project Value: $2,300,000

Energy retrofit of 120 townhouse units in Toronto. Measures include installing air-source heat pumps, low-flow toilets, and heat pump water heaters.

Canam Group – Saint-Gédéon Plant (2017-2018)

Project Value: $2,799,045
Guaranteed Annual Savings: $355,890
Guaranteed Incentives: $1,469,000

Heat recovery from exhaust systems, addition of off-peak electric boilers, unification of boiler rooms, conversion to electric heating in gatehouse and garage.

Canam Group - Quebec Plant (2015-2017)

Project Value: $863,000
Guaranteed Annual Savings: $92,186

Heat recovery, installation of VFDs, optimization of centralized controls.

Saint-François d'Assise Hospital (2014-2017)

Project Value: $9,398,644
Guaranteed Annual Savings: $523,036
Area: 756,703 ft^2

Aerothermal energy and heat recovery, steam to hot water conversion, optimization of chilled water network, ventilation optimization, installation of intelligent hoods, optimization of domestic hot water production, lighting conversion, laundry optimization, steam system optimization, piping replacement.

AWARD

★ **2017 Energia Award, AQME**

Laval University Hospital Center (CHUL) (2011-2016)

Project Value: $21,190,158
Guaranteed Annual Savings: $2,106,000
Area: 1,121,599 ft^2

Steam to hot water conversion, geothermal energy, heat recovery, steam system optimization, optimization of chilled water systems, installation of energy-efficient hoods, conversion of kitchen equipment, decentralization of sterilization equipment, ventilation optimization, ventilation control, fresh air preheating using solar energy, efficient lighting, optimization of centralized controls.

AWARDS

★ **2018 Technology Honorable Mention, ASHRAE**
★ **2017 Wayne McClellan Award, CHES**
★ **2017 Energia Award, AQME**

Mount Sinai Brooklyn – Kings Highway Division, Brooklyn, New York (2011-2012)

Project Value: $4.1 million
Annual Savings: $600,000
Area: 130,494 ft^2

Steam to hot water heating network conversion, cogeneration, lighting retrofit, controls improvement, installation of variable frequency drives, water conservation measures.

AWARDS

★ **2015 EBie Award**
★ **2014 Regional Energy Project of the Year, AEE**
★ **2013 NYC Energy Project of the Year, AEE**

Hauts-Bois-de-l'Outaouais School Board (2010-2012)

Project Value: $7,655,102
Guaranteed Annual Savings: $398,000
Number of Buildings: 25

Lighting conversion, boiler replacements, heat recovery, geothermal energy, installation of electric boilers, biomass heating, ventilation control, secondary heating plant, insulation of domestic hot water network, heat pump.

Sir Wilfrid Laurier School Board – Phase II (2009-2010)

Project Value: $5,610,175
Guaranteed Annual Savings: $319,751
Number of Buildings: 12

Heat recovery, geothermal energy, air-source heat pump, efficient lighting retrofit, replacement of boilers, addition of centralized controls.

Trevor L. Smith, PE

Construction Manager

Trevor joined Ecosystem after seven years of energy engineering and project management experience in the public sector, where he managed the design and implementation of a broad range of energy efficiency and renewable energy technologies across the five boroughs of New York City. As a project manager, he has been part of small working groups that developed new specifications to aid in implementing cutting-edge technologies including LED lighting and Solar Photovoltaics. He was a key manager in the development and oversight of an innovative expedited rooftop Solar Photovoltaic implementation program in New York City.

Trevor is an ardent supporter of sustainable energy efforts to minimize the harmful effects of anthropogenic climate change.

Representative Projects

Bedford Central School District (2019-2023)

Project Value: $8,200,000
Guaranteed Annual Savings: $559,000
Incentives: $555,000
Number of Buildings: 8

Interior lighting upgrade, exterior lighting upgrade, steam-to-hot-water conversion, heat pumps, controls upgrade.

Stuyvesant Town – Peter Cooper Village (2017-2022)

Project Value: $19,284,000
Guaranteed Annual Savings: $2,625,000
Guaranteed Incentives: $1,382,000

Combined heat and power units, high-efficiency boilers, steam peak optimization, electricity resiliency and redundancy, electrical systems upgrade, new gas service, centralized controls for CHP plant.

Rockland Community College (2015-2018)

Project Value: $8,440,000
Guaranteed Annual Savings: $557,000
Number of Buildings: 9

Interior and exterior lighting upgrade, boiler plant upgrade, integrated building management system, variable speed drives, automatic seasonal changeover, water efficiency, fresh air intake improvement, computer load management, combined heat and power generation, installation of high-efficiency centrifugal chiller, installation of natural gas engine driven chiller.

21 Clark Street (2018-2019)

Project Value: $3,500,000

Expedited design-build of steam to condensing hot water boiler conversion and chiller replacement in a historic residential building during its renovation into luxury senior assisted living.

Experience

13 years

Education

- Bachelor of Science, Mechanical Engineering and Mechanics Major, Material Science and Engineering Minor; Drexel University

Professional Licences

- Professional Engineer, CT, DC, MD, NH, NY, RI, MA, IN, ME

Certification

- Certified Energy Auditor
- Certified Energy Manager
- Certified Building Commissioning Professional
- NABCEP Entry-Level Solar Photovoltaic

Training

- OSHA 30-Hour Safety

Memberships

- Association of Energy Engineers

Awards

- AEE NY Renewable Energy Project of the Year 2013
- AEE Northeast Region Renewable Energy Project of the Year 2014

Adelphi University (2015-2016)

Project Value: $13,500,000
Guaranteed Annual Savings: $1,600,000

CHP plant, boiler replacement, ventilation optimization.

AWARD

★ **2019 Energy Project of the Year Award - Long Island Chapter, AEE**

Previous Experience

NYC DOE Rooftop Solar Initiative

Project Value: $22,000,000
Energy Savings: $1,175,000

6.25MW of solar PV on 24 NYC schools

Ted Holden, EIT

Site Supervisor

Ted is a mechanical engineer with a demonstrated background in the construction field. Throughout his education, he held leadership positions focused on philanthropic projects both in the local community and abroad. At Ecosystem, he is proud to combine his experience with technical understanding to produce creative, practical, and sustainable energy solutions.

Representative Projects

ENGIE - Georgetown University (2021-Ongoing)

Project Value: $5,324,427
Energy Use Intensity Reduction: 43%
Number of Buildings: 5

Heat recovery chiller, heating and cooling system upgrades, control system upgrades, kitchen smart hoods.

Stuyvesant Town – Peter Cooper Village - Phase II (2020-2024)

Project Value: $64,850,000
Guaranteed Annual Savings: $9,600,000

Combined heat and power units, high-efficiency boilers, disconnection from central steam network, new steam and hot water district heating network installation

Stuyvesant Town – Peter Cooper Village (2017-2022)

Project Value: $19,284,000
Guaranteed Annual Savings: $2,625,000
Guaranteed Incentives: $1,382,000

Combined heat and power units, high-efficiency boilers, steam peak optimization, electricity resiliency and redundancy, electrical systems upgrade, new gas service, centralized controls for CHP plant.

Blackstone - Kips Bay Court (2020-2021)

Project Value: $7,400,000
Guaranteed Annual Savings: $814,000
Number of Buildings: 8

High- to low-pressure district steam heating conversion, high-efficiency boilers with low-emissions burners, steam peak optimization, electricity resiliency and redundancy, electrical systems upgrade, new gas service.

Mineola Public Schools (2018-2020)

Project Value: $7,268,590
Guaranteed Annual Savings: $373,390
Number of Buildings: 8

Interior and exterior lighting upgrade, steam to hot water conversion, new unit ventilator, hot water boiler upgrade, controls upgrade, oil to gas heating conversion, computer energy manager, solar photovoltaics.

Experience

3 year

Education

- Bachelor of Mechanical Engineering, Rensselaer Polytechnic Institute, 2019

Previous Functions

- 2018: Mechnical Engineering Intern, Syska Hennessy Group
- 2017: Intern, Fresh Meadow Mechanical Corporation
- 2016: Intern, The LiRo Group

Certification

- Engineer in Training (EIT)

Adam Shelly, PE
Project Development Director

Adam is driven to improve his clients' energy environments while reducing the impact on the climate and their balance sheets. His design process is informed by his ability to think both creatively and logically, leading to innovative, high-performance designs. With a strong vision and balanced judgment, he leverages the assets, skills, and needs of all stakeholders in designing solutions. Adam is also known for taking complex technical concepts and communicating them effectively. Adam was awarded AEE's International Energy Engineer of the Year.

Representative Projects

ENGIE - Georgetown University (2021-Ongoing)

Project Value: $5,324,427
Energy Use Intensity Reduction: 43%
Number of Buildings: 5

Heat recovery chiller, heating and cooling system upgrades, control system upgrades, kitchen smart hoods.

International Tailoring Company Building (2021-2023)

Project Value: $7,700,000
Incentives: $1,650,000
GHG Reduction: 80% of onsite emissions

Heat recovery, air-source heat pump, condensing boiler system, adiabatic dry cooler & hybrid water-cooled heat pumps.

Mineola Public Schools (2018-2020)

Project Value: $7,268,590
Guaranteed Annual Savings: $373,390
Number of Buildings: 8

Interior and exterior lighting upgrade, steam to hot water conversion, new unit ventilator, hot water boiler upgrade, controls upgrade, oil to gas heating conversion, computer energy manager, solar photovoltaics.

Rockland Community College (2015-2018)

Project Value: $8,440,000
Guaranteed Annual Savings: $557,000
Number of Buildings: 9

Interior and exterior lighting upgrade, boiler plant upgrade, integrated building management system, variable speed drives, automatic seasonal changeover, water efficiency, fresh air intake improvement, computer load management, combined heat and power generation, installation of high-efficiency centrifugal chiller, installation of natural gas engine driven chiller.

Experience

15 years

Education

- Master of Science in Sustainable Engineering, Villanova University, 2012
- Bachelor of Science in Mechnical Engineering, Washington University in St. Louis, 2008

Qualifications

- Professional Engineer (PE): NY, PA, RI, DC
- Certified Energy Manager (CEM), AEE
- Certified Energy Auditor (CEA), AEE
- Certified Commercial Mechanical Inspector, International Code Council
- LEED AP BD+C, US Green Building Council
- Electrical Contractor License, City of Philadelphia

Associations

- ASHRAE; AEE; Urban Green, USGBC and DVGBC; ASME; AIA

Previous Functions

- 2017-2019: Shelly Electric Company, Inc., Vice President, Operations and Project Manager/Estimator
- 2010-2014: Urban Engineers, Inc., Sustainability Project Manager
- 2008-2014: MEP Design Engineer

Brooklyn Hospital Center (2015-2016)

Project Value: $2,930,000
Guaranteed Annual Savings: $62,000

Chiller installation, optimization of chilled water network.

Marc Trepanier

Senior Mechanical Systems Optimization Specialist

With over 40+ years of experience in the Building Automation System industry, Marc has gained expertise in project management, application engineering, sales and estimating, programming and graphic design, and electrical and mechanical design-builds. Before working at Ecosystem, he successfully completed 183 Building Automation projects of all sizes and complexity for Automated Building Systems. Marc has been recognized for providing top quality, integrity, and commitment, resulting in strong repeat and referral business and the highest confidence in his performance.

Relevant Projects

Tufts University (2021-ongoing)

Project Value: $5,000,000
GHG reduction measures that are NPV-positive.

North Shore Central School District (2019-2022)

Project Value: $7,200,000
Guaranteed Annual Savings: $397,000
Incentives: $52,000
Number of Buildings: 7

Interior lighting, exterior lighting, heating network optimization, building envelope improvements, DDC controls optimization, plug load management, addition of air-conditioning, solar PV.

International Tailoring Company Building (2021-2023)

Project Value: $7,700,000
Incentives: $1,650,000
GHG Reduction: 80% of onsite emissions

Heat recovery, air-source heat pump, condensing boiler system, adiabatic dry cooler & hybrid water-cooled heat pumps.

Massachusetts Trial Courts (DCAMM) (2019-2022)

Project Value: $4,304,716
Guaranteed Annual Savings: $236,898
Incentives: $372,760
Number of Buildings: 4

Lighting upgrade, lighting controls, premium efficiency motors and VFD, high-efficiency boiler replacement, chiller replacement, DDC control system, low flow water fixtures, plug load controllers.

Experience

40+ years

Education

- Bachelor of Science, Computer Engineering and Technical Writing, Roger Williams College
- Associate of Science, Computer Science, Community College of Rhode Island
- Electronic Engineering and Design, New England Technical Institute

Previous Functions

- 2013 - 2022: Senior Project Manager and Acting Operations Manager at Automated Building Systems Inc.
- 1979 - 1991: Lead Draftsman, Engineer's Assistant, Application Engineer, Project Manager's Assistant, and Project Manager at Johnson Controls Inc.

Adam Zielinski

Senior Mechanical Systems Optimization Specialist

With over a decade of experience in control systems solutions, Adam is a skilled engineer specializing in multiple product lines. His background includes projects, both new-build and retrofits, in a variety of environments including laboratories, central plants, and net-zero buildings. One of Adam's most notable projects to date was designing, programming, and installing an integrated control system for an enhanced Biosafety Level 3 laboratory (BSL-3+), a specialty negative-pressure lab for highly contagious, airborne pathogens with limited medical treatment options. Such labs have complex features such as separate ingress and egress airlocks.

Adam values integrated approaches that provide long-term success, meet market requirements, and have the client's best interest in mind. Highly curious, he has a creative outlook on optimization and is constantly expanding his knowledge of cutting-edge technologies. Adam takes pride in his detail-oriented work ethic and team-player mentality. He is passionate about energy management in complex projects and reaching long-term goals for a sustainable future.

Relevant Past Projects

Aaron Diamond AIDS Research Center, Columbia University Medical Center

Full control system design for biological safety level # (BSL-3) research lab, certified by CDC. American Council of Engineering Companies 2021 Category B: Building Designs and Technology Diamond Award winner.

FDNY Fire Rescue 2

BAS and controls design for Net zero energy FDNY facility: CO2 demand control ventilation, geothermal heat pump system, photo-voltaic system, emergency generator integration, Nederman vehicle exhaust extraction system

Experience

12 years

Education

- Master of Science, Energy Management, New York Institute of Technology, 2014
- Certificate in Facility Management, New York Institute of Technology, 2013
- HVAC Design Certificate, New York University, 2011
- Bachelor of Science, Mechanical Engineering, New York Institute of Technology, 2009

Technical Skills

- Programming, JCI PCT/ CCT, Niagara AX/4, System Design, BAS communication protocols, BACnet MSTP/IP

Previous Functions

- 2006-2012: Project manager and senior technician, Autogener

Stephanie Schwartz

Communication & Marketing Director

Calling on a diverse background that combines education, journalism, magazine and book publishing, and copywriting, Stephanie is able to help craft effective print and digital communications for Ecosystem and our clients. She enjoys creating learning opportunities for students and community members interested in our projects, inspiring others to share her commitment to sustainability and environmental responsibility.

Representative Projects/Implementation & Management of Awareness Campaigns

University of Toronto (2022-ongoing)

Detailed engineering and design for U of T's Project LEAP. This project will transform the generation, distribution, and consumption of energy at the St. George campus without impacting operational expenses and reducing GHG emissions significantly.

Humber College (2021-ongoing)

Preliminary Phase Design Services

Detailed design study to decarbonize with a district energy and steam to hot water conversion project. Outcomes include reduced GHG emissions, integration of islanded buildings, improved O&M, energy and water use reduction.

Tufts University (2021-ongoing)

Project Value: $5,000,000
GHG reduction measures that are NPV-positive.

International Tailoring Company Building (2021-2023)

Project Value: $7,700,000
Guaranteed Incentives: $1,650,000
GHG Reduction: 80% of onsite emissions
Heat recovery, air-source heat pump, condensing boiler system, adiabatic dry cooler, hybrid water-cooled heat pimps. This project will achieve full Local Law 97 compliance through 2050, avoiding any potential fines.

DePauw University (2017-2021)

Campus Energy Master Plan and Core Project
Project Value: $14,758,000

Infrastructure initiatives that will lower energy use, reduce energy waste, decrease energy costs, cut greenhouse gas emissions, and address critical deferred maintenance needs. Measures include steam to hot water conversion and centralization of the chilled water network.

Experience

25 years

Education

- Master of Arts, Kings College, University of London
- Bachelor of Arts, University of Pennsylvania

Previous Functions

- Americas Correspondent, IPE Real Estate
- Editorial Consultant, Lienhard School of Nursing, Pace University
- Instructor, Pace University Writing Center
- Managing Editor, Reader's Digest
- Project Editor, Marshall Cavendish Reference

Coxsackie-Athens Central School District (2019-2021)

Project Value: $2,700,000
Guaranteed Annual Savings: $148,000
Guaranteed Incentives: $49,970

Steam-to-hot-water conversion, ventilation upgrades, condensing boiler plant, controls optimization, electrical network optimization, interior and exterior lighting upgrades, computer energy manager, building envelope improvement.

Rockland Community College (2016-2019)

Project Value: $8,440,000
Guaranteed Annual Savings: $518,000
Number of Buildings: 9

Interior and exterior lighting upgrade, boiler plant upgrade, integrated building management system, variable speed drives, automatic seasonal changeover, water efficiency, fresh air intake improvement, computer load management, combined heat and power generation, installation of high-efficiency centrifugal chiller, installation of natural gas engine driven chiller.

Case Studies

Reimagining the campus energy ecosystem for deep cost savings

ENGIE - The Ohio State University

- ✓ Asset renewal
- ✓ Reduced water use
- ✓ Improved O&M
- ✓ Energy cost savings/avoidance
- ✓ Improved resiliency

One of the largest public universities in the United States, the Ohio State University (OSU) enrolls 60,000 students and employs 40,000 staff. Its sprawling 25M ft^2 campus in Columbus, Ohio houses 485 buildings. Among them are three hospitals, museums, libraries, classroom buildings, laboratories, residences, and a 120,000-seat stadium. The campus currently spends $115M annually on energy, including 110 MW of peak demand and 2.9 million MMBtu of steam.

OSU sought both to expand its utility systems and make a major shift toward sustainable development. It wanted a partner to take over campus energy management and to improve energy costs and use. Ecosystem was selected as a key member of the partner team led by Ohio State Energy Partners (formed by ENGIE North America and Axium Infrastructure). As part of our remit, Ecosystem demonstrated exceptional performance in handling sensitive work across multiple laboratories (Physics Research Building, McPherson Chemical Laboratory, and Newman-Wolfrom Laboratory) at OSU.

In a first-of-its-kind project in North America, the partner team will operate and maintain the heating, cooling and electricity infrastructures on campus and sell the energy back to OSU for 50 years.

Customized Performance Measures

- Heat recovery systems
- Heating and cooling systems deep retrofit & optimization
- Steam to hot water conversion
- Ventilation deep retrofit and optimization
- Centralized controls modernization
- Renewable & distributed energy resources

Project Period	**2017-ongoing**
Project Value	**$84M**
Energy Bill Reduction	**30%**
Number of Buildings	**40**

Reference

Robert Cary
Program Manager, ENGIE North America
robert.cary@ENGIE.com
614-937-8375

Address

110 Enarson Hall 154 West 12th Avenue
Columbus, OH 43210

ecosystem

Advancing sustainability through smart asset renewal

Brown University

- ✓ Reduced GHG emissions
- ✓ Asset renewal
- ✓ Reduced operating costs
- ✓ Improved O&M
- ✓ Campus master planning & net-zero strategies

Brown University is an Ivy League institution with 10,000 students and a 146-acre campus. In 2008, Brown announced its intent to reduce greenhouse gas emissions by 42% by 2020. By 2016, a focus on thermal efficiency was the final and most important stage to reach the reduced emissions goal. In response, Brown selected Ecosystem to perform a transformational campus-wide energy efficiency and greenhouse gas reduction project focused on the central heating plant and distribution network as well as building-level improvements.

The project's energy measures overlap with Brown's deferred maintenance and utilities master plans while solving asset renewal challenges. When proven viable, Ecosystem ensured incorporation and reuse of existing assets and materials. For instance, Brown had invested in updating its hot water piping network only a decade earlier, and maintaining this network was more cost-effective than replacement. Ecosystem's engineers also aligned the project to other projects on campus, delivering more outcomes at a lower total cost.

This project is estimated to reduce greenhouse gas emissions by more than 4,700 mTons. Other benefits include significant energy cost savings and water usage reduction.

Customized Performance Measures

- Steam to medium temperature hot water conversion
- Steam hub conversion
- Dedicated steam boiler
- Electric humidification
- Heat recovery loop
- Steam to hot water boiler conversion
- Building Automation System (BAS)

Project Period	**2017-2021**
Investment	**$24.8M**
Incentives	**$1.2M**
Annual Savings	**$1M**

Reference

Michael Guglielmo
Vice President, Facilities Management
michael_guglielmo_jr@brown.edu

401-863-1297

Address

69 Brown St, Providence, RI 02906

2021 SCUP Awards
Excellence in Planning
District or Campus Component

ecosystem

Planning for the sustainable campus in the long-term

Vassar College

- ✓ Reduced operating costs
- ✓ Reduced GHG emissions
- ✓ Improved O&M
- ✓ Roadmap to net zero

Building on Vassar College's 2016 Climate Action Plan that targets carbon neutrality by 2030, the college undertook a study with Ecosystem to identify the best path toward deep decarbonization. The goal of the study was to ensure that the campus made the right investment and took the right first steps to progress to net zero. Vassar aimed to minimize lifecycle cost, improve resiliency and safety, enhance the campus experience, reduce GHG emissions, and maintain long-term flexibility.

Over six months, Ecosystem and Vassar collaborated on an iterative and analytical design process. The targeted outcome was an actionable plan based on potential scenarios and associated infrastructure upgrades. Ecosystem focused on the decarbonization of heating, replacing natural gas and fuel oil with the renewable energy sources. The study also evaluated modifications to the district energy network and the scope of work to the buildings' heating, ventilation, and air-conditioning infrastructure required for compatibility with renewable energy sources.

Ecosystem orchestrated the internal collaboration, ensuring that every stakeholder's needs were accounted for. For example, while the Sustainability Office's main goal was carbon neutrality, Facilities was concerned about cost savings and resiliency. Ultimately, Ecosystem found a proper balance of measures to satisfy all stakeholders.

The study set the stage for future campus projects and proposed a six-step Investment Roadmap to Net Zero. In 2020, the team proceeded to the next stage of implementing proposed changes with Ecosystem.

Customized Performance Measures

- Central heating plant optimization
- Distributed heat recovery
- Central cooling plant optimization
- Ventilation optimization
- Lighting upgrade
- Cooling system retrofit
- Air handling unit replacement

Project Period	**2020-2022**
Investment	**$11.85M**
Incentives	**$1.85M**
Annual Savings	**$905,000**
GHG Emissions Reduction	**21%**

Reference

Bryan Swarthout
VP for Finance and Administration
845-437-5506
brswarthout@vassar.edu

Address

124 Raymond Ave, Poughkeepsie, NY 12604

ecosystem

EUI reduction to cut emissions and maximize ROI

ENGIE - Georgetown University

- ✓ EUI reduction
- ✓ GHG reduction
- ✓ Improved efficiency
- ✓ Simplified O&M
- ✓ Improved occupant comfort

Founded in 1789, Georgetown University is the oldest Catholic and Jesuit institution of higher learning in the United States and a major international research university. Located in Washington, DC, the university has more than 12,000 undergraduate and graduate students and 46 buildings on its main campus.

With aging assets and infrastructure, Georgetown needs to address its asset renewal needs within budget while maximizing ROI and reducing future carbon emissions, leading towards a net-zero campus. To do so within the allocated budget, the university set an energy use intensity (EUI) reduction target of at least 35%, with the potential to increase savings with a campus-wide steam to hot water conversion, renewable energy sources (solar thermal and solar PV), and additional capital improvements.

As a first step towards achieving campus goals, Ecosystem, in partnership with ENGIE, has developed an Energy Conservation Measures (ECM) Program to assess 11 buildings in 2021 and 2022. These buildings represent 25% of total campus buildings, and account for approximately 33% of total campus energy consumption. The ECM Program will identify ECMs to reduce their total EUI. The first four buildings were assessed in 2021, and the proposed ECMs will reduce their EUI by 43% once completed. The next seven building assessments will be completed in the fall of 2022. Construction will commence at the end of 2022.

Project Period	**2021-2023**
Investment	**$4.2m**
EUI reduction	**43%**

Customized Performance Measures

- Heat recovery chillers
- Controls upgrade
- Heating & cooling systems upgrade
- Kitchen smart hoods

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Reducing carbon footprint and energy use with renewable energy

City of Toronto - Emergency Medical Services Headquarters (EMS HQ)

- ✓ Reduced GHG Emissions
- ✓ Reduced Energy Use
- ✓ Maximized Use of Renewable Energy
- ✓ Simplified O&M and Resiliency
- ✓ Improved Comfort

As part of the City of Toronto's ambitious Transform TO and Net Zero Strategy, its Comprehensive Energy Retrofit Program seeks to drastically reduce GHG emissions and energy consumption in City buildings, while maximizing opportunities for renewable energy. The EMS HQ retrofit is one of three pilot projects within the program.

Constructed in 1979, the EMS HQ is a series of interconnected one to three-storey buildings housing the Toronto Paramedic Services and Fire Services and the Toronto Police Services. It is also one of the most critical assets in the City's portfolio. As such, special consideration was given to the design and construction of the project so as not to interrupt critical operations and to ensure safety during implementation - which is no small task when drilling boreholes for a geothermal system in a tight, urban environment. In close collaboration with the City and its stakeholders, Ecosystem developed a solution including ground- and air-source heat pumps as well as solar PV – renewable measures that will not only simplify operations and improve occupant comfort, but also maximize the reduction of GHG emissions and energy use at a reasonable cost.

Once completed in winter 2022, the EMS HQ energy retrofit will reduce the facility's GHG emissions by 73%, its energy consumption by 55%, and address all its critical asset renewal needs.

Customized Performance Measures

- Geothermal heating and cooling
- Heat recovery including garage ventilation heat recovery
- Air-source heat pumps
- Solar PV
- LED lighting
- Heating and cooling systems upgrade
- Controls optimization

Project Period	**2021-2022**
Investment	**$5.2M**
Incentives	**$100,000**
Annual Savings	**$289,000**
Energy Consumption Reduction	**55%**
GHG Reduction	**73%**

Reference

Rick Wu
Project Manager
416 338-3401
rick.wu@toronto.ca

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Reducing Carbon Footprint

City of Toronto - City Waterfront Building

- ✓ Sustainability
- ✓ Improved Comfort
- ✓ Simplified O&M
- ✓ Energy Efficiency
- ✓ Smart Asset Renewal

The City of Toronto set ambitious targets for reducing its GHG emissions. To achieve this, the City committed to a highly innovative project that involves the use of renewable energy. After implementing two (2) preliminary phases of energy improvements at the City Waterfront Building (LED lighting conversion & solar panel installation), the next step involves replacing the heating and cooling equipment.

In order to improve the building's environmental performance to meet set targets, the entire energy production and distribution design had to be reimagined. The cornerstone of the solution is to use a **lake-based hydrothermal system to** heat and cool the building. To accomplish this, the City will install a heat exchange system in Lake Ontario, located right next to the building. In addition, an extensive replacement and upgrade of the Building Automation System (BAS) will eliminate waste by managing the energy supply according to the needs of the various spaces in the building.

Once this sustainability project is completed, the hydrothermal system will provide 100% of the heating and cooling loads, resulting in a reduction in natural gas consumption. Automated building management will simplify operations and maintenance, contribute to annual operational savings of $95,100 and improve occupant comfort. The new, more reliable and efficient equipment will use 60% less energy and emit 79% less GHG.

Customized Performance Measures

- Lake-based hydrothermal system
- BAS replacement, RCx, & standard efficiency measures

Project Period	**2021-2022**
Investment	**$3.1M**
Incentives	**$850,000**
Annual Cost Savings	**$95,100**
Energy Consumption Reduction	**60%**
GHG Reduction	**79%**

Reference

Delina Konomi
Senior Energy Consultant
416 803-2970
delina.konomi@toronto.ca

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Optimizing an efficient building

Centre for Sustainable Development

- ✓ Improved maintenance & operations
- ✓ Reduced operating costs
- ✓ Improved comfort
- ✓ Smart asset renewal
- ✓ Reduced energy use

Completed in 2011, Montreal's Centre for Sustainable Development (Maison du développement durable) is a model for sustainable construction, balancing occupant comfort with environmental impact. As the first LEED® PLATINUM New Construction certified building in Quebec, it houses 18 environmental and community organizations.

In its first five years, despite high efficiency technologies such as heat recovery and geothermal heating, energy performance was below expectations. In addition, the building was expensive to operate and there were frequent complaints about comfort.

To improve the building's efficiency, management partnered with Ecosystem to leverage the building's existing innovative technologies. In a holistic approach, the team reviewed the configuration and sizing of systems, as well as their operating sequences. Addressing interactions between the building's HVAC systems resolved operating issues that allowed for significant improvements at minimal cost. Even in an already efficient building, the team was able to lower electrical demand by a third while reducing energy bills by 35%.

The project demonstrated two important points:

1. A building's energy performance can be improved even when it was designed to meet the highest recognized environmental standards.
2. Building operations must be reassessed continually to maintain optimal performance and comfort.

Customized Performance Measures

- Geothermal network
- LED lighting conversion
- Ventilation system optimization
- Centralized controls optimization

Project Period	**2017-2018**
Annual Savings	**33%**
Incentives	**$18,000**
Energy Bill Reduction	**35%**
GHG Emissions Reduction	**90%**

Reference

Josée Duplessis
General Manager
Maison du développement durable
514-394-1108 x 3710
jduplessis@lamdd.org

2021 ASHRAE Technology Awards, Commercial Buildings Recommissioning

First Place, Existing Building, Region II

"Ecosystem's level of involvement in the project was such that I felt like I was collaborating with members of my own team."

Normand Roy
Former Project Manager, Équiterre

ecosystem

Transformational asset renewal without interrupting operations

Laval University Hospital Center (CHUL)

- ✓ Improved operations & maintenance
- ✓ Reduced GHG emissions
- ✓ Outcome-based asset renewal
- ✓ Reduced utility costs
- ✓ Patient welfare

The Laval University Hospital Center (CHUL) is part of Quebec's University Hospital Center (CHU) network with 12,500 employees that serve two million people. Much of the energy infrastructure was aging and nearing the end of its useful life, and replacing the necessary equipment over a short period of time was financially prohibitive. To finance upgrades to the electromechanical equipment, CHUL decided to leverage energy savings while reducing their environmental footprint.

Highlights included a steam to hot water conversion, during which 900 radiators were replaced across six floors housing several departments and patient rooms. Ecosystem worked closely with CHUL to develop air quality best practices and minimize disruption to patients during installation. In the laboratory, Ecosystem installed motion sensors on each of the lab's 43 hoods along with a centralized air sampling system, enabling efficient air quality monitoring, responsive air evacuation rates, reduced maintenance costs, and significant energy savings. Most of the project's savings come from the addition of a heat recovery network and an 850-ton centralized heat pump.

In addition to cost savings of almost $2M per year, the hospital's annual greenhouse gas emissions have been reduced by 8,075 metric tons of CO_2, equivalent to removing 3,575 cars from the road each year.

Customized Performance Measures

- Geothermal energy
- Heat recovery
- Steam to hot water conversion
- Steam system optimization
- Decentralization of sterilization equipment
- Chilled water optimization
- Centralized controls optimization
- Ventilation control and optimization
- Fresh air preheating using solar energy

Project Period	**2011-2015**
Investment	**$21.2M**
Guaranteed Incentives	**$9.5M**
Guaranteed Annual Savings	**$1.9M**
Energy Use Reduction	**35%**

Reference

Patrick Ouellet
Assistant Director of Technical Services
patrick.ouellet.ciussscn@ssss.gouv.qc.ca

2018 Honorable Mention, ASHRAE

2017 Wayne McClellan Award, CHES

2017 Energia Award, AQME

ecosystem

Uninterrupted operations while ensuring dramatic savings

Olympic Park

- ✓ Improved maintenance & operations
- ✓ Uninterrupted operations
- ✓ Improved comfort
- ✓ Asset renewal
- ✓ Reduced GHG emissions

Launched for the 1976 Summer Olympics, Montreal's Olympic Park now hosts three million visitors annually. The park's highly variable heating and cooling loads added complexity to an essential HVAC infrastructure upgrade. The project became an investment in the future of the park with a focus on asset renewal. Measures included a major steam to hot water conversion of the heating system, along with improved heat recovery and a completely redesigned chilled water system.

In this project, Ecosystem integrated various asset renewal needs into one holistic approach. This approach allowed optimal sizing of the new chillers, cooling towers, and other components, significantly increasing the overall efficiency and reducing energy consumption. In addition, Ecosystem completed in 30 months what would have taken the Olympic Park staff seven or eight years.

For the Olympic Park, continuing to hold major events during construction was a top priority. Ecosystem's ability to carry out the project while adhering to tight timelines and maintain operability was crucial. For instance, the Toronto Blue Jays were scheduled to play three months after the contract was signed. The games would attract 40,000 spectators and require cooling. To ensure that a new cooling system would be operational for the series, Ecosystem agreed to work with equipment purchased ahead of the final contract signing and then operated the system manually during the games. Energy savings reached $1.7 million during the first year of M&V, well above expectations.

Customized Performance Measures

- Steam to hot water conversion
- Heat recovery
- Control of peak electric demand
- Cooling system upgrade
- Lighting conversion
- Chiller replacement
- Ventilation system optimization
- Controls upgrade

Project Period	**2015-2018**
Investment	**$22.7M**
Incentives & Asset Renewal	**$8.8M**
Guaranteed Annual Savings	**$1.3M**
Energy Bill Reduction	**38%**
GHG Emissions Reduction	**83%**

2019 ASHRAE Technology Awards, Public Assembly - Existing Building, Region II

2018 AEE Energy Project of the Year Award, Canada Region

"What we're able to achieve in 33 months with Ecosystem would have taken us 8 to 10 years using a traditional model and the savings would have likely fallen short, whereas Ecosystem's project came with guaranteed savings."

Maurice Laundry, Eng., PMP
Vice President, Construction and Maintenance

Multiple habitats, holistic solution

Montreal Biodome Space for Life

- ✓ Improved animal, plant & visitor welfare
- ✓ Improved O&M
- ✓ Reduced energy use
- ✓ Reduced GHG emissions
- ✓ Energy bill reduction

The Biodome is part of the Montreal Space for Life, the largest natural science museum complex in Canada. It welcomes over 800,000 visitors annually. Its unique 377,000 ft^2 building features 4,800 animal and 750 plant species within five distinct habitats. These habitats have a range of climatic needs in terms of temperature, humidity and light.

In alignment with its commitment to protecting the environment and biodiversity, the Montreal Biodome sought to dramatically reduce its GHG emissions while addressing comprehensive asset renewal needs.

Ecosystem specialists collaborated with the Biodome's staff and zoologists on a creative solution that dramatically cut energy consumption and waste. The tropical environment was heated using an internal heat recovery system that pumped in heat generated from chilling the arctic environment. Ecosystem also uncovered the existence of an underground river and leveraged it to design an efficient, inexpensive geothermal system that satisfied all outstanding building heating needs. The system currently stands as the largest of its type in Canada.

Careful planning with experts such as zoologists and biologists ensured that animal and plant welfare were maintained and enhanced and the visitor experience preserved throughout implementation. Ecosystem worked closely with the Biodome operations team to design a new controls sequence, which reduced the time and effort to fine-tune building systems to readiness.

Customized Performance Measures

- Heat recovery and transfer system
- Geothermal system
- Steam to hot water conversion
- Fan and pump optimization
- Lighting redesign and conversion
- Centralized controls optimization

Project Period	**2008-2010**
Investment	**$9.6M**
Incentives	**$1.6M**
Annual Savings	**$1.3M**
Energy Bill Reduction	**52%**
GHG Emissions Reduction	**80%**

Reference

Jean Bouvrette
Head of Technical Services Dept.
jbouvrette@ville.montreal.qc.ca

2015 AEE International Energy Project of the Year

2013 ASHRAE Technology Award

2012 FCM Sustainable Communities Award

2011 AQME Energia Award

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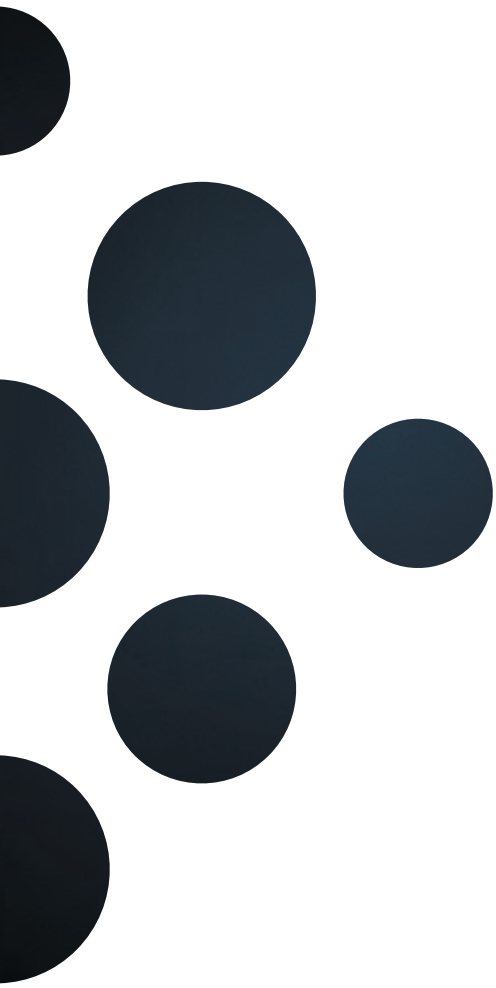
Capturing Existing Asset Value



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CAPTURING EXISTING ASSET VALUE

Reusing & Repurposing

Reusing and/or repurposing existing infrastructure components is often ignored or overlooked as part of the spectrum of tools and options that can maximize value in energy projects.

Traditionally, existing equipment and systems are replaced with new ones in these types of projects on the assumption that this eliminates risk. However, this traditional approach forfeits the intrinsic value of existing infrastructure and any related benefits associated with equipment that is already in place.

By taking a holistic approach when assessing electromechanical systems and their interconnected parts, it is possible to determine which elements or components can be reused for their original intent or repurposed to add value to the new system.

Thoughtful inclusion of existing assets can add significant value to projects if implemented correctly. Benefits include accelerated project timelines, reduced disruption, improved system performance, and reduced costs (capital and operating expenses). There are also added environmental and sustainability benefits that come with reusing or re-purposing existing assets.

Opportunity Cost

Overlooking existing assets may cost your organization in time and money, resulting in significant opportunity cost.

While it may be technically simpler to replace existing assets, it may also be less financially prudent for the owner as measured by opportunity cost and lost benefits of reusing and re-purposing existing assets – especially in projects where existing equipment and systems can be maximized without sacrificing quality.

Disposing of assets that can fit into the new electromechanical system is wasteful for the following reasons:

1. There may be less capital- and labor-intensive alternatives (re-engineering parts of the existing system to optimize performance) that yield the same or better results than adding new components.
2. Implementation and operations may be simplified by reusing or repurposing existing equipment.
3. Unnecessary replacement of a viable asset forgoes capturing the full value or sunk cost of the asset.

The Status Quo

Project teams often overlook the value of existing assets during energy and sustainability projects.

The traditional approach is to replace the old with the new – irrespective of the intrinsic value of existing assets in electromechanical systems. There are several factors underlying this common approach:

1. **Payment structure –** Contractor and engineer fees are typically structured as a percentage of total contract value in traditional procurement models. In these cost-plus models, smaller project costs translate to smaller contractor fees and vice versa. This does not incentivize the contractor to reduce project costs. The contractor may make decisions that maximize fees – in this case, replace old equipment with new and perhaps overdesigned options to drive project cost up within allowable limits.

2. **Risk –** There is perceived risk in reusing or re-purposing existing assets. If the system does not function as intended or achieve the desired results, the project owner ultimately bears the risk, especially if the project is implemented by multiple engineers and contractors. As a result, it is often deemed safer to purchase new equipment that may promise certain performance but does not necessarily make the system more efficient or reliable than the existing equipment.

3. **Project complexity –** Particularly in complex energy projects, replacing the entire system can be a simpler (although not better) way to achieve the desired results. It takes innovative thinking and a deep understanding of electromechanical systems and their interconnectivity to maximize the value of existing assets while delivering the project's intended outcomes.

The basis for overlooking existing assets – while seemingly practical – ultimately does not serve the owner or the project. What is often ignored is the opportunity cost in time, money, and lost value of existing assets.

The Right Mindset

The intent of reusing and repurposing existing assets is to add project value by maximizing the value of what is already in place. This strategy is not intended to reduce project costs at the expense of quality.

Within this context:

- **REUSE** means continuing to use equipment for its original intent
- **REPURPOSE** means adding value by using existing equipment for a new purpose or function

With this understanding, project teams must think of the opportunities within ageing systems and uncover solutions that use existing assets without compromising the quality of the project.

Instead of throwing out the entire electromechanical system, parts of the system within walls, underground, or in mechanical rooms can be reused or repurposed to meet today's performance standards. For example, in steam to hot water conversions, steam pipes can be repurposed as hot water pipes, eliminating the need to install a new piping network.

Reusing and repurposing requires careful planning.

It takes a deep understanding of the electromechanical system, its interconnecting parts, and how they function to determine what combination of strategies will best serve a project.

Design and construction engineers must work closely together, relying on techniques and strategies to develop solutions that will indeed maximize existing asset utility while deliver the project outcomes. For example:

- **Steam pipe repurposing –** In steam to hot water conversions, repurposing steam pipes for hot water use eliminates the need for new pipes. In existing buildings, this reduces disturbance to the structural integrity of the facility and reduces disruption to occupants during implementation.
- **Using existing terminal networks –** When switching from a high- to a low-temperature network, it is possible to re-engineer the terminal network to function efficiently by cascading loads; engineering a high delta T network can eliminate the need to replace high-cost terminal equipment.
- **Refurbishment of select high-value equipment –** Certain high-quality and costly equipment that fits into future requirements of energy systems should be considered over lower-quality replacements.

Risk Mitigation

To reduce the risk associated with extending the useful life of existing assets, it is important to conduct thorough tests and assessments that ensure the quality and integrity of the existing asset.

Cost reduction should not be the sole driver when deciding to reuse or repurpose existing assets. The decision must be justified by fully accounting for risk and ensuring that the asset will function as intended.

Some important risk mitigation strategies to ensure integrity of assets include:

- **Planning –** Invest the time upfront during the early design and engineering phases of the project to determine the value of existing assets and how they fit into the proposed new system.
- **Facility Condition Index –** Review asset renewal needs and deferred maintenance backlogs to determine components that can be used while satisfying capital planning requirements.
- **Physical testing –** Visually inspect, pressure test, conduct a systems assessment, check control compatibility, verify code compliance (CSA, UL), and sample for corrosion and wear as part of the consideration process.
- **Terminal equipment –** Test the operating condition of terminal equipment to ensure it can meet new system requirements.
- **Commissioning –** Include commissioning and controls specialists early in the process when system modifications are part of the plan.

Advantages

Once risk has been properly mitigated and quality verified, there are benefits to reusing or repurposing existing assets. These advantages should be viewed as benefits of the approach and should not drive the decision to reuse or repurpose assets.

Some important advantages include:

1. **Maximized outcomes –** Organizational objectives and goals can be maximized by optimizing the use of existing assets within new systems – essentially doing more with less. This strategy can drive project costs down while still delivering the intended outcomes, including addressing asset renewal and deferred maintenance backlogs.

2. **Reduced disruption –** Reusing or repurposing assets is less disruptive since entire systems do not have to be removed and replaced. In some cases, existing components may need to be re-engineered to fit within the new system. In others, only specific parts of the system need to be replaced. The result in either case is reduced disruption to facilities and their occupants.

3. **Easier change management –** System operators, already familiar with existing systems, do not have to relearn entirely new components, reducing the learning curve associated with energy modernization projects. This leads to quicker and easier adoption.

4. **Accelerated project timeline –** By investing time in the planning and design effort upfront, the implementation timeline can be reduced. This is especially true if the existing assets that can be reused or repurposed would require disruptive processes that add to the project timeline, such as large-scale trenching or working within walls.

5. **Sustainability –** By reusing or repurposing existing assets, the project's environmental impact is reduced. This strategy avoids having to dispose of useful assets and eliminates the environmental footprint created by the manufacture, packaging, and installation of unnecessary new equipment.

Takeaways

1. Existing assets have value that should be considered when planning asset renewal projects
2. Reusing and repurposing is a tool worth considering in complex energy retrofit projects
3. The implementation of new energy networks should not equate to the wholesale disposal of old networks
4. Analyze the entire system and its inter-connected parts holistically when making decisions.
5. Redesign energy networks by considering the future energy landscape.
6. Reusing and repurposing should not be treated as a goal, but rather as a tool to achieve intended outcomes — it adds value when applied correctly.

CASE STUDY Olympic Park

Located in the heart of Montreal, the Olympic Park welcomes more than four million visitors annually. Its facilities include the Olympic Stadium, built for the 1976 Olympics, and the Biodome Space for Life, a unique nature museum in the former Olympic Velodrome that showcases five distinct ecosystems under one roof.

Faced with rising energy costs, aging assets, and high energy use intensity (EUI), the Olympic Park needed to dramatically reduce energy consumption as well as GHG emissions. The park's highly variable heating and cooling loads added complexity to an essential HVAC infrastructure upgrade. Measures included a major steam to hot water conversion of the heating system, along with improved heat recovery and a completely redesigned chilled water system.

By repurposing kilometers-long steam piping, reusing terminal equipment by re-engineering the system, and reusing high-quality equipment, the project was completed in 30 months for a fraction of the projected cost.

The project won the 2018 AEE Energia Project of the Year Award and the 2019 ASHRAE Technology Awards.

Reuse & Repurpose Strategy	Results
• Repurpose steam piping for steam to hot water conversion – Low carbon technology • Reuse of terminal equipment – Increased ΔT • Refurbish select high-quality equipment	• 57% GHG reduction • Improved operation and maintenance • Uninterrupted operations • 26% energy cost savings

CASE STUDY University of Quebec in Trois Rivieres (UQTR)

The extensive UQTR campus relied on four independent chilled water loop networks with eight chillers at the end of their useful life. The university wanted to reduce energy consumption but also faced several operational challenges, especially the complex maintenance and operation of its extensive high-temperature hot water system. Because of the size of the campus, recovering and transferring heat between buildings was both a challenge and the key to unlocking significant energy savings.

To solve multiple problems, the heating network was converted to a lower temperature, heat recovery and transfer was optimized, cooling was added in several locations, and outdated equipment removed.

Instead of installing eight new chillers, the four chilled water loop networks were connected, two chillers were installed with the capacity to provide cooling to the entire system, and the network was re-engineered. The chilled water network was re-engineered into a heat recovery network to displace the use of fossil fuels. The project eliminated inefficiencies and addressed the operating issues caused by decentralized equipment -- the lower-temperature hot water network is not only safer but also simpler to operate and maintain. UQTR is now one of the most energy-efficient campuses in Quebec.

Reuse & Repurpose Strategy	Results
• Re-engineer existing chiller network	• 53% GHG reduction • Improved operation and maintenance • Asset renewal • 25% energy cost savings

CASE STUDY Quebec City University Hospital Center

Consisting of five hospitals, the Quebec City University Hospital Center (CHU) provides care for 2 million people annually. With its aging infrastructure, the Center needed to modernize obsolete electromechanical equipment in critical areas like emergency rooms and operating theaters and reduce costs and its environmental footprint.

Deep energy retrofits of four of the five hospitals were complex due to their size, ambitious scope of work, and need for continuity of critical operations. A steam to hot water conversion allowed new sources of heat recovery to be installed. This configuration maximized equipment efficiency and the use of the heat pumps in winter while taking full advantage of Quebec's low hydro prices to reduce the use of natural gas.

The project also included renewable energy measures such as a solar wall to preheat fresh air during the winter and a geothermal system that leveraged an existing 30-mile (50 km) network of underground piping.

The project won the 2017 Wayne McClellan Award and 2017 Energia Award and received honorable mention from ASHRAE in 2018.

Reuse & Repurpose Strategy	Results
• Replace terminal radiators with minimal disruption	• 56% GHG reduction • Uninterrupted operations • 30% energy cost savings

CASE STUDY Brown University

In 2008, Brown announced its intent to reduce greenhouse gas (GHG) emissions by 42% by 2020. By 2016, a focus on thermal efficiency was the final stage to reach the reduced emissions goal.

In response, a transformational campus-wide energy efficiency and GHG reduction project focused on the central heating plant and distribution network as well as building-level improvements. The project's energy measures overlapped with Brown's deferred maintenance and utilities master plans while solving asset renewal challenges.

The design ensured incorporation and reuse of existing assets and materials to maximize the value of Brown's recent capital expenditures. For instance, Brown had invested in updating its hot water piping network only a decade earlier, and maintaining this network was more cost-effective than replacement. The project was also aligned with other initiatives on campus, reducing total cost.

This project is estimated to reduce GHG emissions by more than 4,700 metric tons. Other benefits include significant energy cost savings and water usage reduction.

Reuse & Repurpose Strategy	Results
• Re-engineer the heating loop • Repurpose steam piping in steam to hot water conversion • Refurbish select high-quality equipment	• Asset renewal • 40% GHG reduction • Improved resiliency • Improved operation and maintenance

CASE STUDY Lakeridge Health

Located 50 kilometers east of Toronto, Lakeridge Health (LH) provides care for 650,000 people in five hospital locations. A deep energy retrofit of four of its sites renewed energy infrastructure, improved efficiency, and enhanced patient comfort.

Due to the sensitive nature of hospital environments, it was essential to minimize disruption. For this project, repurposing existing steam pipes in the steam to hot water conversion, and re-engineering the existing cooling loop network made both functional and financial sense.

The project won multiple awards including the 2013 Green Hospital of the Year, 2014 Environmental Achievement Award, and 2017 Best Overall / Collaboration Award and was a top 15 green project in 2015.

Reuse & Repurpose Strategy	Results
• Repurpose steam piping in steam to hot water conversion – low carbon technology • Re-engineer cooling loop	• 25% energy cost savings • Maintaining patient welfare • Asset renewal • Improved resiliency

Yale Sample Schedule

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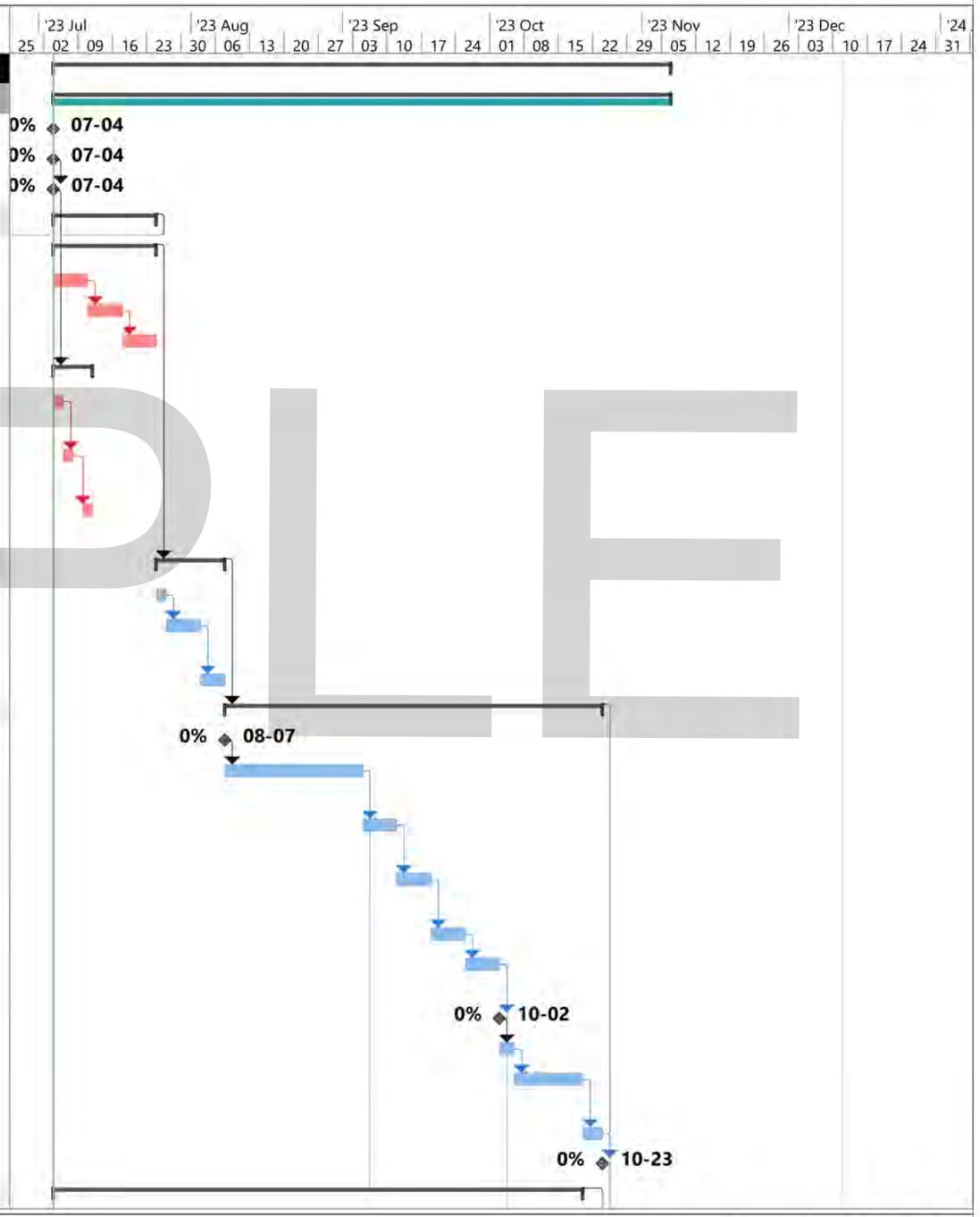
Project Template
Master Schedule

ID	Task Name	Duration	% Complete	Start	Finish	Predecesso	Successors
1	**Yale University**	**90 days?**	**0%**	**Tue 23-07-04**	**Mon 23-11-06**		
2	**Preliminary Steps**	**90 days?**	**0%**	**Tue 23-07-04**	**Mon 23-11-06**		
3	**RFP Process by Client**	**0 days**	**0%**	**Tue 23-07-04**	**Tue 23-07-04**		
4	RFP Issuance	0 days	0%	Tue 23-07-04	Tue 23-07-04		5
5	Proposal Issuance	0 days	0%	Tue 23-07-04	Tue 23-07-04	4	11
6	**Pre-Contract Design Engineering**	**15 days**	**0%**	**Tue 23-07-04**	**Mon 23-07-24**		**50**
7	**Alignment of Interest**	**15 days**	**0%**	**Tue 23-07-04**	**Mon 23-07-24**		**15**
8	Define Roles & Responsabilities for all pa	5 days	0%	Tue 23-07-04	Mon 23-07-10		9
9	Clear Understanding of Stakeholders	5 days	0%	Tue 23-07-11	Mon 23-07-17	8	10
10	Define Project Objectives & KPIs	5 days	0%	Tue 23-07-18	Mon 23-07-24	9	
11	**Document Management**	**6 days**	**0%**	**Tue 23-07-04**	**Tue 23-07-11**	**5**	
12	Confirm Document Mgnt Requirements from Client	2 days	0%	Tue 23-07-04	Wed 23-07-05		13
13	Confirm Document Sharing Good Practices (Naming Convention, shared	2 days	0%	Thu 23-07-06	Fri 23-07-07	12	14
14	Confirm Document Format (Agenda, Meeting Minutes, Action Log)	2 days	0%	Mon 23-07-10	Tue 23-07-11	13	
15	**Initiating Collaborative Design Engineering**	**10 days**	**0%**	**Tue 23-07-25**	**Mon 23-08-07**	**7**	**19**
16	Review of the RFP vs the Needs w/ Stakeho	2 days	0%	Tue 23-07-25	Wed 23-07-26		17
17	Perform Interviews with Operation Team from Client	5 days	0%	Thu 23-07-27	Wed 23-08-02	16	18
18	Confirm Alignment toward Design 20% w/ C	3 days	0%	Thu 23-08-03	Mon 23-08-07	17	
19	**Pre-Contract Design Engineering**	**55 days**	**0%**	**Mon 23-08-07**	**Mon 23-10-23**	**15**	**44**
20	Initiate Design 20%	0 days	0%	Mon 23-08-07	Mon 23-08-07		21
21	20% Engineering to Client - Drawings & Eng. Narrative	20 days	0%	Tue 23-08-08	Mon 23-09-04	20	22,32
22	Collaborative Working Session & Comments on 20% Enginering	5 days	0%	Tue 23-09-05	Mon 23-09-11	21	23
23	Cost Estimation First Draft to Client for Comments (±25%)	5 days	0%	Tue 23-09-12	Mon 23-09-18	22	24
24	Definition of Alignment toward 50% Engine	5 days	0%	Tue 23-09-19	Mon 23-09-25	23	25
25	50% Engineering to Client - Drawings & Eng. Narrative	5 days	0%	Tue 23-09-26	Mon 23-10-02	24	26,38
26	Cost Estimation ±15% to Client	0 days	0%	Mon 23-10-02	Mon 23-10-02	25	27
27	Value Engineering Session #1	3 days	0%	Tue 23-10-03	Thu 23-10-05	26	28
28	Review of Pre-Contract 50% Engineering as Required	10 days	0%	Fri 23-10-06	Thu 23-10-19	27	29
29	Value Engineering Session #2	2 days	0%	Fri 23-10-20	Mon 23-10-23	28	30
30	50% Detailed Design Acceptance by Client	0 days	0%	Mon 23-10-23	Mon 23-10-23	29	
31	**Pre-Contract Project Management**	**78 days?**	**0%**	**Tue 23-07-04**	**Thu 23-10-19**		**44**



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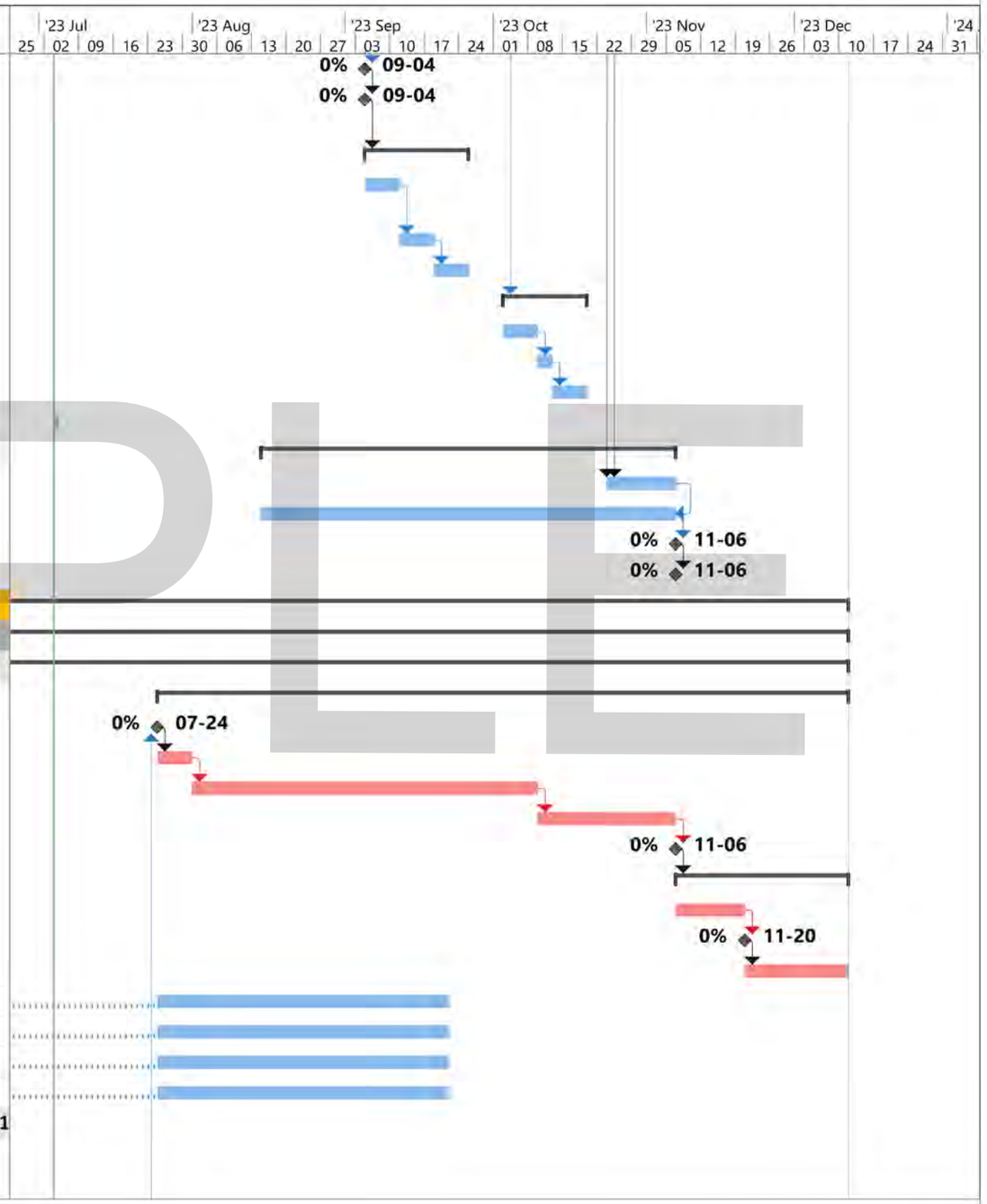
Project Template
Master Schedule

ID	Task Name	Duration	% Complete	Start	Finish	Predecesso	Successors
32	First Draft Schedule Issued to Client	0 days	0%	Mon 23-09-04	Mon 23-09-04	21	33
33	Permits & Authoriations Required by Authorities Shared w/ Client	0 days	0%	Mon 23-09-04	Mon 23-09-04	32	34
34	**Client/Ecosystem Collaborative Working S**	**15 days**	**0%**	**Tue 23-09-05**	**Mon 23-09-25**	**33**	
35	Key Annually Planned Shutdowns Shared by Client	5 days	0%	Tue 23-09-05	Mon 23-09-11		36
36	Downtime Period Discussion	5 days	0%	Tue 23-09-12	Mon 23-09-18	35	37
37	Single Point of Failure Discussion	5 days	0%	Tue 23-09-19	Mon 23-09-25	36	
38	**Contractural Schedule Discussion**	**13 days**	**0%**	**Tue 23-10-03**	**Thu 23-10-19**	**25**	
39	Review of the 50% Design Eng. Schedule	5 days	0%	Tue 23-10-03	Mon 23-10-09		40
40	Collaborative Working Session	3 days	0%	Tue 23-10-10	Thu 23-10-12	39	41
41	Agreement on Key Project Milestones	5 days	0%	Fri 23-10-13	Thu 23-10-19	40	
42	<New Task>	1 day?	0%	Tue 23-07-04	Tue 23-07-04		
43	**Contractual Steps**	**60 days**	**0%**	**Tue 23-08-15**	**Mon 23-11-06**		
44	Review of Financial w/ Client	10 days	0%	Tue 23-10-24	Mon 23-11-06	19,31	45FF
45	Contractual Negotiation	60 days	0%	Tue 23-08-15	Mon 23-11-06	44FF	46
46	Contract Signature	0 days	0%	Mon 23-11-06	Mon 23-11-06	45	47
47	PO Issuance Date	0 days	0%	Mon 23-11-06	Mon 23-11-06	46	
48	**To Be Determined**						
49	**Pre-Construction Steps**	**815 days**	**5%**	**Mon 20-10-26**	**Mon 23-12-11**		
50	**Permits & Authorizations**	**815 days**	**9%**	**Mon 20-10-26**	**Mon 23-12-11**	**6**	
51	Mechanical	100 days	0%	Mon 23-07-24	Mon 23-12-11		
52	Mechanical drawings confirmed	0 days	0%	Mon 23-07-24	Mon 23-07-24	71	53
53	Application initiated	5 days	0%	Tue 23-07-25	Mon 23-07-31	52	54
54	Processing period	50 days	0%	Tue 23-08-01	Mon 23-10-09	53	55
55	Revision period	20 days	0%	Tue 23-10-10	Mon 23-11-06	54	56
56	Approval	0 days	0%	Mon 23-11-06	Mon 23-11-06	55	57
57	Closing Procedure	25 days	0%	Tue 23-11-07	Mon 23-12-11	56	
58	Request for Inspection	10 days	0%	Tue 23-11-07	Mon 23-11-20		59
59	Inspection	0 days	0%	Mon 23-11-20	Mon 23-11-20	58	60
60	Permit Closure	15 days	0%	Tue 23-11-21	Mon 23-12-11	59	
61	Structural	50 days	14%	Mon 20-10-26	Thu 23-09-21		
62	Electrical	50 days	14%	Mon 20-10-26	Thu 23-09-21		
63	Architectural	50 days	14%	Mon 20-10-26	Thu 23-09-21		
64	Other Discipline ABC	50 days	14%	Mon 20-10-26	Thu 23-09-21		
65	**Drawings & Specs**	**55 days**	**21%**	**Mon 20-10-26**	**Mon 21-01-11**		**98,100,109,11**
66	Mechanical Drawings	55 days	11%	Mon 20-10-26	Mon 21-01-11		
67	On-site surveys	7 days	100%	Mon 20-10-26	Wed 20-11-04		68



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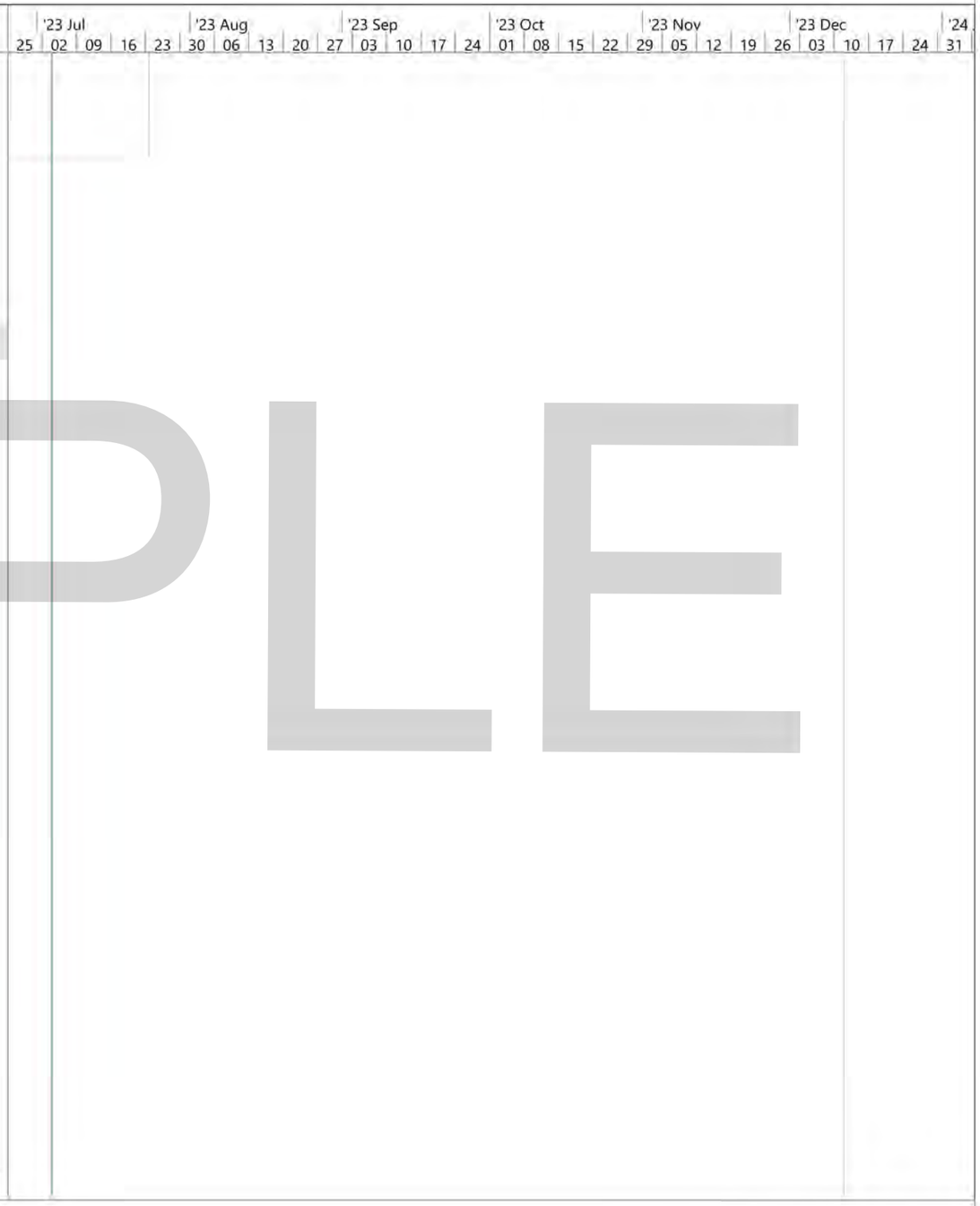
Project Template
Master Schedule

ID	Task Name	Duration	% Complete	Start	Finish	Predecesso	Successors
68	60% completion	14 days	0%	Thu 20-11-05	Tue 20-11-24	67	69,70
69	Client Review	10 days	0%	Wed 20-11-25	Tue 20-12-08	68	72
70	90% completion	7 days	0%	Wed 20-11-25	Thu 20-12-03	68	71
71	Issued for Permits	7 days	0%	Fri 20-12-04	Mon 20-12-14	70	72,52
72	Issued for RFP	10 days	0%	Tue 20-12-15	Mon 20-12-28	71,69	73,101
73	Issued for Construction	10 days	0%	Tue 20-12-29	Mon 21-01-11	72	153
74	Electrical Drawings	28 days	25%	Mon 20-10-26	Thu 20-12-03		
75	Architectural Drawings	21 days	33%	Mon 20-10-26	Tue 20-11-24		
76	Structural Drawings	21 days	33%	Mon 20-10-26	Tue 20-11-24		
77	**Procurement & Contracting**	**155 days**	**2%**	**Mon 20-10-26**	**Mon 21-05-31**		
78	RFP - Equipement	155 days	3%	Mon 20-10-26	Mon 21-05-31		116,118
79	Boilers	100 days	14%	Mon 20-10-26	Mon 21-03-15		
80	Identify & Contact Subcontractors	15 days	47%	Mon 20-10-26	Mon 20-11-16		
81	RFP Document Preparation	15 days	47%	Mon 20-10-26	Mon 20-11-16		82
82	RFP Issuance Date	0 days	0%	Mon 20-11-16	Mon 20-11-16	81	83
83	Bidding Period	15 days	0%	Tue 20-11-17	Mon 20-12-07	82	84
84	Quote analysis and negociation	5 days	0%	Tue 20-12-08	Mon 20-12-14	83	85
85	Contract award	0 days	0%	Mon 20-12-14	Mon 20-12-14	84	
86	Shop Drawings	20 days	35%	Mon 20-10-26	Mon 20-11-23		91
87	Shop Drawings Obtained	10 days	70%	Mon 20-10-26	Mon 20-11-09		88
88	Shop Drawing Internal Revision	5 days	0%	Tue 20-11-10	Mon 20-11-16	87	89
89	Shop Drawing Approval by CLIENT N	5 days	0%	Tue 20-11-17	Mon 20-11-23	88	90
90	Shop Drawing Approval	0 days	0%	Mon 20-11-23	Mon 20-11-23	89	
91	Equipment Leadtime	80 days	0%	Tue 20-11-24	Mon 21-03-15	86	135
92	Heat pumps	100 days	0%	Tue 21-01-12	Mon 21-05-31	65	
93	Pumps	100 days	0%	Tue 21-01-12	Mon 21-05-31	65	
94	CHPs	100 days	0%	Tue 21-01-12	Mon 21-05-31	65	
95	VFDs	100 days	0%	Tue 21-01-12	Mon 21-05-31	65	
96	Heat exchangers	100 days	0%	Tue 21-01-12	Mon 21-05-31	65	
97	Fan coils	100 days	0%	Tue 21-01-12	Mon 21-05-31	65	
98	RFP - Subcontractors	45 days	0%	Tue 21-01-12	Mon 21-03-15	65	
99	Mechanical	45 days	0%	Tue 21-01-12	Mon 21-03-15		
100	Identify & Contact Subcontractors	15 days	0%	Tue 21-01-12	Mon 21-02-01	65	
101	RFP Document Preparation	15 days	0%	Tue 21-01-12	Mon 21-02-01	65,72	102
102	RFP Issuance Date	0 days	0%	Mon 21-02-01	Mon 21-02-01	101	103
103	Bidding Period	10 days	0%	Tue 21-02-02	Mon 21-02-15	102	104
104	Quote analysis and negotiation	5 days	0%	Tue 21-02-16	Mon 21-02-22	103	105



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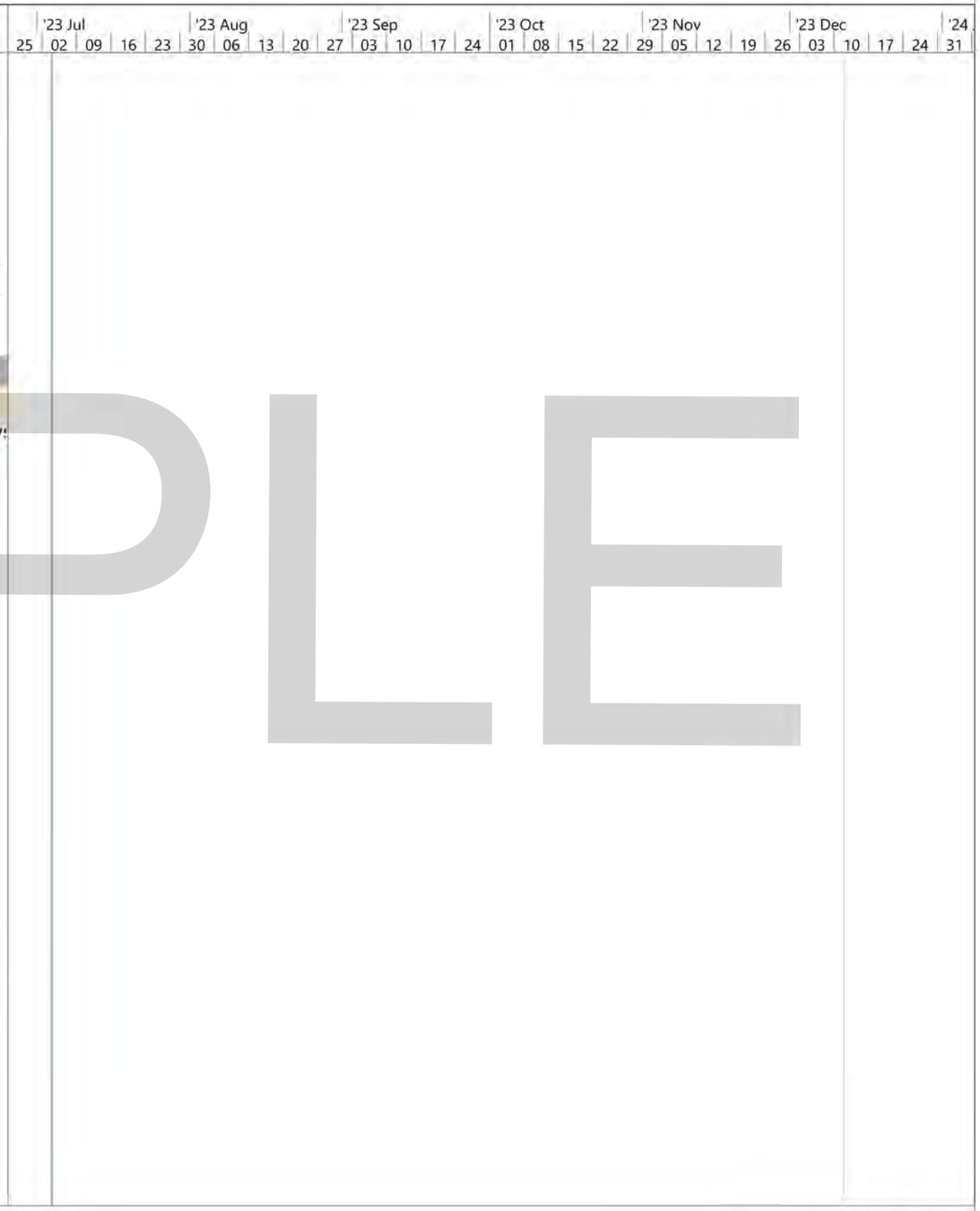
Project Template
Master Schedule

ID	Task Name	Duration	% Complete	Start	Finish	Predecesso	Successors
105	Contract award	0 days	0%	Mon 21-02-22	Mon 21-02-22	104	106
106	Mobilization Period	15 days	0%	Tue 21-02-23	Mon 21-03-15	105	
107	Electrical	45 days	0%	Tue 21-01-12	Mon 21-03-15		
108	Plumbing	28 days	0%	Tue 21-01-12	Thu 21-02-18		
109	Control	28 days	0%	Tue 21-01-12	Thu 21-02-18	65	
110	Architectural	21 days	0%	Tue 21-01-12	Tue 21-02-09		
111	Fire Sprinkler System	7 days	0%	Tue 21-01-12	Wed 21-01-20		
112	Engineering	28 days	0%	Tue 21-01-12	Thu 21-02-18	65	
113	Demolition	21 days	0%	Tue 21-01-12	Tue 21-02-09	65	
114	Asbestos Abatement	14 days	0%	Tue 21-01-12	Fri 21-01-29	65	
115	**Implementation**	**323 days**	**0%**	**Tue 21-06-01**	**Thu 22-08-25**		**163,160,153**
116	**Per measure**	**323 days**	**0%**	**Tue 21-06-01**	**Thu 22-08-25**	**78**	
117	Measure 1 - Steam to hot water conversion	158 days	0%	Tue 21-06-01	Thu 22-01-06		147SS+50 days
118	ACM - Asbestos Containing Material	30 days	0%	Tue 21-06-01	Mon 21-07-12	78	124
119	Identify Areas of Work	5 days	0%	Tue 21-06-01	Mon 21-06-07		120
120	Confirm ACM	10 days	0%	Tue 21-06-08	Mon 21-06-21	119	121
121	Initiate Removing Procedures	5 days	0%	Tue 21-06-22	Mon 21-06-28	120	122
122	Removing & Disposing Process	10 days	0%	Tue 21-06-29	Mon 21-07-12	121	
123	Demolition	12 days	0%	Tue 21-07-13	Wed 21-07-28		
124	Gas Piping Isolation	2 days	0%	Tue 21-07-13	Wed 21-07-14	118	125
125	Electrical Disconnection of Equipment	5 days	0%	Thu 21-07-15	Wed 21-07-21	124	126
126	Mechanical Review prior to Dismantle	5 days	0%	Thu 21-07-22	Wed 21-07-28	125	127
127	Concrete Pads	10 days	0%	Thu 21-07-29	Wed 21-08-11	126	130
128	Location Confirmed w/ Client	5 days	0%	Thu 21-07-29	Wed 21-08-04		
129	Concrete Pads Pourring Work	10 days	0%	Thu 21-07-29	Wed 21-08-11		
130	Equipment delivery	21 days	0%	Thu 21-08-12	Thu 21-09-09	127	
131	In-Advance Notice for Road Closure	20 days	0%	Thu 21-08-12	Wed 21-09-08		134
132	In-Advance Notice to Client	15 days	0%	Thu 21-08-12	Wed 21-09-01		135
133	Temporary Structure for Delivery	5 days	0%	Thu 21-08-12	Wed 21-08-18		134
134	Road Closure Confirmed w/ Public Enti	0 days	0%	Wed 21-09-08	Wed 21-09-08	133,131	135
135	Craning Operation	1 day	0%	Thu 21-09-09	Thu 21-09-09	134,91,13	141,136
136	Equipment installation and piping	30 days	0%	Fri 21-09-10	Thu 21-10-21	135	144
137	Mechanical Work	30 days	0%	Fri 21-09-10	Thu 21-10-21		142
138	HW Boiler Installation	30 days	0%	Fri 21-09-10	Thu 21-10-21		
139	Pumps Installation	15 days	0%	Fri 21-09-10	Thu 21-09-30		
140	HEX Installation	10 days	0%	Fri 21-09-10	Thu 21-09-23		
141	Electrical Work - Connection to Equipn	20 days	0%	Fri 21-09-10	Thu 21-10-07	135	
142	Insulation Work	15 days	0%	Fri 21-10-22	Thu 21-11-11	137	143



ecosystem

Project Template
Master Schedule

ID	Task Name	Duration	% Complete	Start	Finish	Predecesso	Successors
143	Contingencies	40 days	0%	Fri 21-11-12	Thu 22-01-06	142	
144	Measure 2 - Heat recovery measure	220 days	0%	Fri 21-10-22	Thu 22-08-25	136	147SS+50 days
145	Measure 3 - Lighting conversion	120 days	0%	Tue 21-06-01	Mon 21-11-15		147SS+50 days
146	Measure XYZ	240 days	0%	Tue 21-06-01	Mon 22-05-02		
147	Deficiency Process	100 days	0%	Thu 21-12-30	Thu 22-05-19	117SS+50	
148	Project deficiency process confirmed with	0 days	0%	Thu 21-12-30	Thu 21-12-30		149
149	Deficiency List shared - Client/Ecosystem	20 days	0%	Fri 21-12-31	Thu 22-01-27	148	150
150	Addressing deficiencies	80 days	0%	Fri 22-01-28	Thu 22-05-19	149	
151	**Project Closeout Process**	**66 days**	**0%**	**Thu 22-08-25**	**Fri 22-11-25**		
152	**Closeout Documentation**	**45 days**	**0%**	**Thu 22-08-25**	**Thu 22-10-27**		
153	As-Built Drawings	30 days	0%	Fri 22-08-26	Thu 22-10-06	73,115	165
154	Mechanical	30 days	0%	Fri 22-08-26	Thu 22-10-06		
155	Redline from subcontractor	10 days	0%	Fri 22-08-26	Thu 22-09-08		156
156	On-Site Inspection	10 days	0%	Fri 22-09-09	Thu 22-09-22	155	157
157	As-Built Issuance	10 days	0%	Fri 22-09-23	Thu 22-10-06	156	
158	Electrical	20 days	0%	Fri 22-08-26	Thu 22-09-22		
159	[...]	20 days	0%	Fri 22-08-26	Thu 22-09-22		
160	Subcontractors Shop Drawings	30 days	0%	Fri 22-08-26	Thu 22-10-06	115	165
161	Mechanical	30 days	0%	Fri 22-08-26	Thu 22-10-06		
162	[...]	30 days	0%	Fri 22-08-26	Thu 22-10-06		
163	Operations & Maintenance Manual	45 days	0%	Thu 22-08-25	Thu 22-10-27	115	
164	Table of Content Shared w/ Client	0 days	0%	Thu 22-08-25	Thu 22-08-25		165
165	Information Completed	0 days	0%	Thu 22-10-06	Thu 22-10-06	164,153,1	166
166	O&M Manual Issued to Client	0 days	0%	Thu 22-10-06	Thu 22-10-06	165	167
167	O&M Acceptance from Client	15 days	0%	Fri 22-10-07	Thu 22-10-27	166	169
168	**Contractual Closeout Process**	**21 days**	**0%**	**Fri 22-10-28**	**Fri 22-11-25**		
169	As per the contract - Contract to be Review	7 days	0%	Fri 22-10-28	Mon 22-11-07	167	170
170	Subtasks	14 days	0%	Tue 22-11-08	Fri 22-11-25	169	171
171	Certificate of Substantial Performance of the \	0 days	0%	Fri 22-11-25	Fri 22-11-25	170	

Exhibit B & C

Exhibit B

Designated Personnel, Consultants and Subcontractors

B.1 Design/Builder's Designated Representative. The design/builder's designated representative for the Project is:

Robert Mancini, Director of Business Development

Additional representatives are presented in the Team Profile section of this proposal.

B.2 Design/Builder's Designated Personnel and hourly rates

The hourly fees presented below were used to develop the lump sum pricing presented for the pre-design phase. Should more time or additional resources be required, they will be included at no additional cost to Yale. At Ecosystem, we focus on delivering the outcomes and not on calculating hours. Additional subject matter experts will be participating in the project on an as-needed basis to help deliver a project that addresses Yale's needs.

Name	Position	Rate ($/hr)
Andre-Benoit Allard	Sr Project Director	325
JP Drouin	Sr Director, Project Development	325
Robert Mancini	Director of Business Development	300
David Bonneau	Sr Director, Technical Solutions	300
Simon Lessard	Sr Director, Technical Solutions	300
Max Lamirande	Director, Project Development	300
Lucas Taub	Team Lead – Project Engineer	225
Gabrielle Turcot, Ph.D.	Project Engineer	150
Kevin Fortin	Sr Project Director	325
Trevor Smith	Team Lead – Construction Engineer	225
Ted Holden	Project Engineer	200
Adam Shelly	Project Development Director	300
Marc Trepanier	Sr Mechanical Systems Optimization Specialist	225
Adam Zielinski	Sr Mechanical Systems Optimization Specialist	225
Stephanie Schwartz	Communication Director	250

B.3 Staffing Plan

The staffing plan has been included in the Team Profile section of the proposal.

B.4 Design/Builder's Consultants:

All the work required in the pre-design phase to develop a project scope and pricing will be conducted by Ecosystem's in house team of experts. Should consultants or sub-contractors, such as a testing and balancing contractor, be required, they will be identified during the pre-design investigation planning phase.

B.5 Design Builders subcontractors

See B.4

B.6 Adjustment of Rates

N/A

EXHIBIT C

TERMS OF COMPENSATION

C.1 Compensation. The Design/Builder's compensation for the Work shall consist only of the Fee plus Reimbursable Expenses as set forth below in § C.1.1.

C.1.1 Breakdown for portions of Fee:

Description	Fee	Basis	Reimbursable Expenses
Pre-Design Phase	$450,000	Lump Sum	Included
Direct Aggregate Project Cost	**Fee**		**Reimbursable Expenses**
Design Phase	10%		Included
Procurement Phase	2%		Included
Construction Phase	7%		Included
Performance Monitoring Phase	3%		Included
Direct Mark Up	10%		Included
Total Mark-up	32%		

C.3 Extent of Authorization. The Design/Builder is authorized to perform solely the portion(s) or phase(s) of the Design/Builder's Work set forth below, which is the limit of the Owner's commitment and obligation to the Design/Builder's under the Agreement. Subsequent portion(s) and phase(s) of the Design/Builder's Work may be authorized in the Owner's sole discretion, and only by the issuance of an executed Change in Services. The Design/Builder acknowledges and agrees that the Owner has no obligation to authorize subsequent portion(s) or phase(s) or to compensate the Design/Builder for services undertaken but not authorized.

[Specify committed portion(s) or Phase(s) of Services]

* Additional information about this approach and fees are presented in the "Project Agreement" section of the report.

Attachment C
Comments

YALE UNIVERSITY
REQUEST FOR PROPOSALS
for
SCIENCE HILL
ENERGY SERVICES
YALE UNIVERSITY FY24 – FY29

Please proposals electronically in a single package to:
Michael.Ghilani@yale.edu

TABLE OF CONTENTS

I. INTRODUCTION, PURPOSE, AND BACKGROUND:

a. Introduction

1) Yale University ("Yale" or "the University") seeks a comprehensive proposal from firms and partnering firms ("teams") to investigate, formulate, and implement comprehensive zerocarbon readiness projects within select laboratory buildings in operation on Science Hill at Yale's Central Campus.

b. Purpose

1) The purpose of this initiative is to complete zero-carbon readiness projects within select laboratory buildings to enable the use of a low temperature hot water utility for heating, remove steam process loads, install on-site solar, and to significantly reduce energy use intensity with comprehensive energy conservation measures.
   a. Target average energy use intensity for the initiative is less than 150 kBTU/GSF measured at the building level.
   b. "Zero-carbon readiness" is defined as highly energy-efficient and prepared to utilize energy that will be generated with renewable sources in the future. Zero-carbon readiness does not require "net-zero" emissions at project completion.

2) Yale seeks one qualified and experienced team to partner with the University to investigate, design, and construct comprehensive projects with an initial value between $24M and $30M. Yale intends to directly fund proposed work and is not seeking financing, a savings guarantee, or a performance contract.

3) The selected team will begin pre-design investigation work in October 2023 with completion of projects by end of December 2028 parallel with the construction and operation of the Science Hill Thermal Utility Plant. Performance monitoring will continue for an additional year minimum.

4) Yale Facilities will oversee project development and execution.

5) The selected team will be required to assume sole responsibility for the complete scope of work and will be the sole point of contact regarding contractual matters. Yale will enter a master design/build contract with complete transparency in pricing.

c. Background

1) Yale is a private university located in New Haven, Connecticut. Chartered in 1701, Yale is one of the world's leading scientific research institutions, with more than 520 leased and owned buildings and 21 million gross square feet (GSF) of space. The facility inventory is a mix of historical and newly constructed buildings with the campus spread across 835 acres.

2) Yale has a student population of 14,525 including undergraduates, graduate, and professional students with 15,652 faculty and staff.

3) Yale is committed to achieving zero actual carbon emissions by 2050 with an interim goal to reach net zero emissions by 2035. More information about Yale's commitment to climate action may be found here: https://sustainability.yale.edu/priorities-progress/climateaction/climate-action-strategy

4) Yale is developing a new physical sciences and engineering research complex on Science Hill which will be comprised of an approximately 290,000 GSF research laboratory building, a 48,00 GSF addition to Wright Laboratory, a 22,000 GSF chemical safety building, and a 14,500 GSF new Thermal Utility Plant with geothermal wellfield. The Thermal Utility Plant will provide low-temperature hot water to heat the laboratory buildings listed in this RFP.

5) Yale has completed extensive energy conservation projects across all three campuses including most of the buildings listed in this RFP over the past nearly twenty years.

II. PROCUREMENT SCHEDULE

RFP Issued to Pre-Qualified Teams	**June 8, 2023**
Site Visit	**June 21, 2023**
RFP Clarification Questions	**June 23, 2023**
RFP Clarification Answers	**June 29, 2023**
Proposal Due	**July 10, 2023**
Interviews (TBD)	**August 1-3, 2023**
Anticipated Selection for Pre-Design	**August 11, 2023**
Anticipated Pre-Design Kick-Off	**Early October 2023**

Yale University reserves the right to make changes to the above-mentioned schedule. All such changes shall be made by an addendum. Registered candidates will be provided with information concerning this solicitation, including any addenda or notices.

III. **TERMS OF SUBMISSION PROCESS**

a. Yale University reserves the right to terminate the selection process at any time.

b. This RFP and any subsequently offered contracts will be governed by the laws of the State of Connecticut. All applicable valid executive orders, Federal, State or local laws, ordinances or rules or regulations shall apply to any contract if and when offered and are deemed incorporated herein.

IV. SCOPE OF SERVICES

Scope of work will consist of the following key tasks and deliverables:

a. Pre-Design: Complete investigation activities for each building identified in Attachment A.

1) Building Review

- Team shall survey buildings and review existing documentation, equipment, EH&S concerns, capital projects in progress, and building automation system configuration and trends to begin investigation activities.

2) Investigation Plan

- Team shall create a plan to conduct all investigation activities necessary to complete a fully calibrated energy model and to understand the scope surrounding elimination of steam utility use within the building and converting systems to low temperature hot water.
- Any activities that require outside contractors and vendor support shall be clearly identified. Those activities may include, but are not limited to:

    a) Submetering
    b) Lab airflow verification
    c) Testing & balancing
    d) Fume hood reviews
    e) Infiltration tests
    f) BAS trending & programming support
    g) All other vendor supported equipment tests.

- Following Yale review and approval of plan, the supporting work necessary (identified within the plan) shall be procured and submitted as a Construction Proposal. Please note that sub-contracted investigative activities will be funded as a separate Construction Proposal outside of Pre-Design T&E fee.

3) Calibrated Energy Model

- Team shall collect and analyze data to create whole building hourly energy models of each building to demonstrate energy by end use calibrated to current condition & operation. Yale will specify the end use categories that shall be included for each building.

4) Energy Conservation Analysis

- Target Setting: Team shall propose and model energy conservation measures, including system, equipment, envelope, and operational modifications, that need to be implemented to achieve high performance in each laboratory and target a sitewide energy use intensity of 150 kBTU/GSF measured at the building level. It

is required that a building-by-building energy model demonstrates that the site-wide target is achievable.

- Feasibility: Each proposed measure should be further investigated to understand an approximate scope of work and costs to implement each measure. The feasibility analysis shall include:
    1. Estimated costs, energy savings, energy cost savings, user impact, and utility financial incentives for each measure.
    2. All applicable calculations, assumptions, and estimations. Cost estimates for the work to be implemented shall be detailed. Team shall conduct contractor walk-throughs and obtain vendor quotes to better inform cost estimates when necessary. It is understood that typical cost estimating methods alone will not suffice in the current economic environment.
    3. Team shall provide Yale with live energy savings spreadsheets and software model files as applicable. Yale will enter into a non-disclosure agreement to protect proprietary software.

5) Renewable Energy Analysis

- Low Temperature Hot Water: Team shall evaluate and propose scope of work and costs necessary to convert existing heating systems to low temperature hot water and connect to HW supply at future location provided by PSEB Thermal Plant project. Yale anticipates the hot water distribution systems will operate between 120- and 140-degrees F depending on the time of year.
- Process Steam: Team shall evaluate and propose scope of work and costs to eliminate use of plant steam for process loads.
- On-site solar: Team shall evaluate and propose scope of work and costs to install solar on the roof of each building.
- It is understood that individual scopes of work to enable renewable energy systems may also be viewed as energy conservation measures without further load reduction activities, and feasibility analysis shall include:
    1. Estimated costs, energy savings, energy cost savings, user impact, and utility financial incentives for each scope.
    2. All applicable calculations, assumptions, and estimations. Cost estimates for the work to be implemented shall be detailed. Team shall conduct contractor walk-throughs and obtain vendor quotes to better inform cost estimates when necessary. It is understood that typical cost estimating methods alone will not suffice in the current economic environment.
    3. Team shall provide Yale with live energy savings spreadsheets and software model files as applicable. Yale will enter into a non-disclosure agreement to protect proprietary software.

6) Investigation Report

- Team shall compile findings from all investigation activities and submit a final deliverable that details conclusions and a set of recommendations moving forward. Complete costs and savings calculations for all measures shall be included.

At the end of the Pre-Design investigative phase, Yale will have the right to select which measures and scopes of work are pursued in the Design phase or to terminate the agreement completely.

b. Design: At the direction of Yale, the Team shall proceed with design of selected energy conservation measures and other scopes of work to allow elimination of steam utility.

1) Design phase shall include three primary deliverables: 50% progress submission, 90% progress submission, and 100% Construction Documents. Documentation shall be generated in accordance with Yale University Design Standards and Yale Office of Environmental Health & Safety Policies and Procedures, available here: **Facilities Design Standards for Capital Projects**

https://facilities.yale.edu/contractor-consultant-resources/design-guidelines/yaleuniversity-design-standards-capital-project

Environmental Health & Safety Policies & Procedures

https://ehs.yale.edu/about/policies-procedures

2) Team shall coordinate with all stakeholder groups including Facilities Planning, Project Management, and Operations, and Departmental academic and operational leaders, EH&S and Yale ITS.

3) As part of Construction Documentation, Team shall provide all final calculations and documentation to secure financial incentives from relevant incentive programs. It should be noted that Yale will apply for and receive any incentives directly from the utility and not use them to offset construction cost by payment directly to contractor.

4) If the team identifies scope that impacts the original cost estimation, then estimated costs, energy savings, energy cost savings, user impact, and utility financial incentives shall be updated for Yale's review.

At the end of the Design phase, Yale will have the right to select which measures and scopes of work move forward to procurement phase or to terminate the agreement completely. Yale will also have the right to terminate at 50% or 90% submissions during the Design phase and will

compensate the Team for completed work in accordance with the DB-10 Professional Services Agreement between Owner and Design/Builder.

c. Procurement: At the direction of Yale, the team shall provide all services associated with procurement of selected energy conservations measures and scopes of work.

1) Team shall pursue construction subcontractor bidding, pricing, and selection with Yale review and approval.

2) Procurement phase shall include one primary deliverable: a complete Construction Proposal.

At the end of the Procurement phase, Yale will have the right to select which measures and scope of work move forward to construction or to terminate the agreement completely.

d. Construction: At the direction of Yale, the team shall provide all services associated with construction of selected energy conservations measures and scopes of work.

1) Construction Administration & Management:

- Obtaining of all required permits and approvals
- Securing utility incentives and facilitating final documentation and inspection to receive incentive
- Managing subcontractors
- Communication with stakeholders
- Commissioning and functional testing
- Planning for post-occupancy performance activities
- Training of facility personnel and occupants
- Project close-out and turnover

2) The team is required to have a full-time presence onsite during the Construction phase. Office space will be made available at Yale. The team will be required to assume sole responsibility for the complete scope of work and will be the sole point of contact regarding contractual matters.

e. Performance Monitoring: Following the substantial completion of scope of work, the team shall monitor performance and achievement of energy savings.

1) Analytics: Yale utilizes Clockworks Analytics to monitor various equipment and systems on campus including within the buildings in the RFP. The team shall propose an appropriate expansion of Clockworks or alternative approach to monitor performance for a minimum of one-year post completion. It is expected that the team selected will monitor Clockworks Analytics and provide periodic reports to Yale detailing findings and overall performance of systems and equipment within the buildings in the scope.

2) This phase shall be viewed as a "continuous commissioning" period as well as verification of performance. Any design or construction issues identified during this period shall be addressed to full resolution by the Team. It is understood that some issues identified may require extension of warranties after deficiencies are rectified.

V. PROPOSAL REQUIREMENTS

Candidates are requested to prepare and submit a comprehensive proposal to be reviewed by a Selection Committee.

a. Team Profile: Present specific team members and roles, including:

1) Team leader, including full contact information.

2) Resumes of individuals to be directly involved in the project and proposed role, including individuals from partnering firms. Indicate who will be working on-site during various phases of the project.

3) Provide an organizational chart. If the roles and responsibilities are different for each phase of work, indicate that clearly or provide multiple organizational charts.

b. Project Approach: Describe the approach that your team proposes to complete the scope of work required, including:

1) Pre-Design
2) Design
3) Procurement
4) Construction
5) Performance-Based Commissioning

c. Project Agreement: Appendix C includes the proposed Professional Services Agreement that Yale will execute with selected team lead. The proposal must provide a definitive list of exceptions (if any) to Yale University's Form of Agreement. No further exceptions will be considered beyond those noted within your proposal.

d. Project Cost Structure:

1) Provide a project cost breakout using the table provided as Appendix D.

- Pre-Design Phase: Please provide a time & expense not-to-exceed proposal and rate sheet to perform the investigation phase. Note that additional subcontracted investigation activities as detailed in the Investigation Plan will be funded as a Construction Proposal.
- Design/Procurement/Construction/Performance Monitoring Phase
  a) "Direct Aggregate Project Costs" (DAPC) includes only procured materials, permits and subcontracted work necessary for a complete project.
  b) "Design" and "Procurement" covers professional services and should include costs for subcontracted engineering and other professional services if proposed. No additional mark-up to be included for subcontracted engineering or other professional services. Any additional soft costs such as travel and other direct expenses shall be included in mark-up. No additional reimbursement shall be offered.

c) "Construction" covers company construction and post construction management activities, and engineering construction administration services and commissioning for construction closeout.

d) "Performance Monitoring" covers monitoring and commissioning activities during the post-construction / warranty phase.

e) "Direct Mark-up" shall only apply to direct costs for the aggregate projects. Any additional soft costs such as insurance, contract administration, accounting, other support functions, overhead, and profits shall be covered in this mark-up and shall not be included as project costs.

- No additional costs will be paid for above the direct aggregate project cost that are not identified in the proposal.

e. Next Steps: The proposal process includes the following two activities:

1) **Site Visit:** Yale has coordinated a site visit on June 21, 2023, beginning at 10:00 AM. Two individuals from each team may participate in this site visit which will be approximately 2 hours in duration.

2) **RFP Clarification Questions**: Any questions on the RFP shall be submitted by June 23, 2023, and will be answered in writing by June 29, 2023.

3) **Interview:** Following review of the proposals by the Selection Committee, Yale may invite up to four (4) teams to participate in an on-site interview between August 1-3, 2023.

VI. SUBMISSION OF PROPOSAL

Electronic submission of your proposal package will be due on Monday, July 10, 2023 by 5:00 PM ET and emailed to michael.ghilani@yale.edu.

VII. ATTACHMENTS

Attachment A: Overview of Selected Buildings

The following table summarizes metrics for the 6 buildings included in the initial project scope. It is anticipated that these buildings will be provided with low temperature hot water from the new PSEB Thermal Plant.

Table 1: Energy Use Intensity: Calendar Year 2021

Building	GSF	Total MMBtu	CHW MMBtu	Electric MMBtu	Steam MMBtu	HW MMBTU	Gas MMBtu	EUI kBTU/GSF
Bass Center	91,017	32,205	12,384	6,856	12,965	0	0	354
Chemistry Research Building	118,020	35,107	10,593	12,561	11,951	0	1	297
Kline Chemistry Lab	79,863	38,260	12,439	7,902	17,919	0	0	479
Sterling Chemistry Lab	215,672	49,364	13,846	10,551	24,956	0	12	229
Yale Science Building	272,582	85,972	28,501	36,512	20,959	0	0	315
Sloane Physics Lab	85,422	14,575	2,600	4,799	7,176	0	0	171
Total	862,576	255,483	80,363	79,181	95,926	0	13	296
Target	*862,576*	*<130,000*	*TBD*	*TBD*	*0*	*TBD*	*0*	*<150*

More information about monthly energy use may be found here:
https://java.facilities.yale.edu/energy/

The following section provides general overview of each building.

Bass Center, Nancy Lee and Perry R. (BASS)
266 Whitney Avenue
- Architects, 1993: KMW Architecture
- Style: Postmodern
- Area: 91,000 GSF; three floors, plus half-ground floor
- Use: Research laboratories
- Occupant: Department of Molecular Biophysics and Biochemistry

The Bass Center houses research laboratories, office, meeting spaces, and a lecture hall for biophysics and biochemistry. The completion of this building initiated an on-going program to add new, and comprehensively renovate existing Science Hill facilities to accommodate increasingly advanced research needs. The brick and brownstone building frames the north side of the Science Hill

quadrangle. Its gabled ends, sloped roof, and ridge-mounted "chimneys," concealing lab exhaust ducts, recall traditional building elements, as does the building's interior grand stairway rising within a twostory atrium. The Bass Center is connected to the adjacent Yale Science Building and John W. Sterling Chemistry Laboratory by way of pedestrian bridges. Its ground-level service dock accommodates delivery and receiving operations shared with the adjacent Yale Science Building, Kline Tower, and Sloan Physics Laboratory via an interconnected underground concourse level. The building is named after its lead benefactors Nancy Lee and Perry R. Bass, BA 1937.

Chemistry Research Building, The Class of 1954 (CRB) 275 Prospect Street

- Architects, 2005: Bohlin Cywinski Jackson, CannonDesign
- Style: Postmodern
- Area: 117,900 GSF; three floors, plus basement
- Sustainability: LEED Silver certified
- Use: Research laboratory
- Occupant: Department of Chemistry

The Class of 1954 Chemistry Research Building (CRB) is located at the northern end of the Department of Chemistry's three interconnected labs, which include Kline Chemistry Laboratory and Sterling Memorial Laboratory. CRB consolidates chemistry's intensive fume-hood dependent research. The brick-clad building's architecture, and enclosed courtyard that it shares with Kline Chemistry Laboratory, evokes Yale's iconic neo-Gothic style, including the use of ornamental entry gates as seen at Prospect Street, designed by Kent Bloomer, BA 1959, MFA 1961. The lab's interiors feature medium and large seminar rooms, two breakrooms per floor, and an Instrument Lab. CRB was the first LEED certified chemistry lab in the world. The building is named after its lead benefactors, alumni of the Class of 1954.

Kline Chemistry Laboratory (KCL)
255 Prospect Street

- Architect, 1964: Philip C. Johnson, DFAH 1978
- Renovation, 2014: HBRA Architects
- Thomas H. Beeby, MArch 1965, Dean of the School of Architecture (1985–91)
- Style: Modern, New Formalism
- Area: 79,800 GSF; two floors, plus basement
- Sustainability: LEED Gold certified
- Use: Research laboratory

- Occupant: Department of Chemistry

Kline Chemistry Laboratory (KCL) is the second of three buildings that comprise the Kline science centers, including Kline Geology Laboratory and Kline Tower, which were built sequentially to update laboratory facilities at Science Hill. All three buildings were designed as variations of the same gridwork theme of horizontal brownstone spandrels set in between attached brick columns. Narrow, floor-to-ceiling windows punctuate the brick façades of each building. KCL was intended as a modern lab annex to the Sterling Chemistry Laboratory, and both are connected via east and west corridors, which were later extended as northern connections to the Chemistry Research Building. These interconnections created courtyards on both sides of KCL which separate the three labs from each other. Kline Chemistry Laboratory is named after its lead benefactor C. Mahlon Kline, PhB 1901.

Sterling Chemistry Laboratory (SCL)

225 Prospect Street

- Architects, 1923: Delano & Aldrich (William A. Delano, BA 1895, BFA 1907, MAH 1939)
- Landscape architect, 1924: Beatrix C. Farrand, MAH 1925
- Renovation and addition, 2016: CannonDesign with HBRA Architects

- Style: Neo-Gothic
- Area: 215,600 GSF; three floors
- Sustainability: LEED Gold certified
- Use: Research and teaching laboratory
- Occupant: Department of Chemistry

The red brick and Longmeadow stone-clad Sterling Chemistry Laboratory (SCL) is the oldest of the tripart chemistry complex comprised of SCL, Klein Chemistry Laboratory, and the Chemistry Research Building. SCL's main entry is highlighted by a three-story arched window set into the middle of a solid façade that, except for the first floor, is windowless. Corner turrets and attached pilasters divide the length of the façade into sections which feature decorative terra cotta panels depicting symbols from the periodic table and alchemy. The building plan is U-shaped with lecture halls, classrooms, offices, library, shops, computational labs—and former top-level student dormitories, now offices—are located on the outer perimeter of the building. SCL's teaching and research laboratories are enclosed in the center of the facility, within an independent steel framed complex covered by saw-toothed skylights. This functional design is modelled on industrial exemplars to accommodate flexible partitioning and maximized natural lighting. Innovative for its time, the laboratory's experimental ventilation system was less successful, and required immediate corrective work. Prone to deterioration, SCL's skylights were concealed or removed by a renovation in 2016 which added a third floor, a mechanical penthouse, an expanded basement, new fume hoods and support labs. The renovated core lab area consolidates most of Science Hill's chemistry, biology, and physics teaching labs within SCL, with vibration

sensitive research labs remaining at the lower level. Fume intensive research labs are situated in adjacent Chemistry Research Laboratory and Klein Chemistry Laboratory. The latter is separated from SCL by a shared outdoor courtyard that provides natural lighting to both labs' social areas. The building is named after its lead benefactor John W. Sterling, BA 1864.

Yale Science Building (YSB)
260 Whitney Avenue

- Architects, 2019: Stantec with Pelli Clarke and Partners
- César Pelli, DFAH 2008, Dean of the School of Architecture (1977–84)
- Style: Modern
- Area: 272,600 GSF; six floors, plus rooftop greenhouse
- Sustainability: LEED Gold certification
- Use: Research laboratory

The Yale Science Building (YSB) is a steel, glass, and brick-clad research laboratory that was built on the site of the former Josiah W. Gibbs Laboratories. The structure accommodates research and support facilities for the Department of Molecular, Cellular, and Developmental Biology; part of the Department of Molecular Biophysics and Biochemistry; the Quantitative Biology Institute; and vibration sensitive physics labs. YSB's elevations consist of a tartan patterned weave of vertical columns and horizontal metal brise-soleil screens, which echo the column and spandrel gridwork comprising masonry façades of the adjacent Kline Geology Laboratory and Kline Tower. In contrast to older laboratories, YSB's fenestration maximizes natural lighting, and its open lab plans, and flexible mechanical, plumbing, and electrical systems accommodate custom fitouts. In addition to laboratories, YSB houses a rooftop greenhouse, an insectary, and a cryo-electron microscopy suite, and vibration sensitive physics labs resting atop bedrock at an adjacent courtyard. The facility features Science Hill's largest classroom, O. C. Marsh Lecture Hall, which is a 500-seat space that incorporates a landscaped roof garden and the Schamis Terrace, which rests on top of its computational center. The Yale Science Building connects to the neighboring Bass Center at grade and via an underground concourse to Klein Tower, Sloane Physics Laboratory, Kroon Hall, Marx Library, and the Pavilion social center and café.

Sloane Physics Laboratory (SPL)
217 Prospect Street

- Architect, 1912: Charles C. Haight
- Landscape architect, 1924: Beatrix C. Farrand, MAH 1925
- Style: Neo-Gothic
- Area: 85,400 GSF; three floors, plus half-basement
- Use: Research and teaching laboratory

- Occupant: Department of Physics

Sloan Physics Laboratory (SPL) is Science Hill's oldest laboratory facility. Its neo-Gothic design was intended to extend the architectural fabric of Yale's Old Campus and Memorial Quadrangle to Science Hill. The L-shaped building is clad in Longmeadow brownstone and houses the Department of Physics' academic and administrative offices, labs, and classrooms, including two of Science Hill's oldest lecture halls. SPL's first floor and half-floor connect to Kline Tower, and it shares a common plaza with the adjacent Sterling Chemistry Building to its north. The building is named after its lead benefactors Henry T. Sloane, BA 1869, and William D. Sloane, MAH 1889.

Attachment B: Anticipated Project Schedule

Pre-Design Kick-Off	**October 2023**
Pre-Design Phase	**October 2023 – January 2025**
Yale Evaluation & Approval	**February 2025 – July 2025**
Design, Procurement, Construction, Monitoring	**August 2025 - December 2028**
Project Close-Out	**January 2029 – December 2030**

Yale University reserves the right to make changes to the above schedule which is for general informational purposes during the RFP process.

Attachment C: Proposed Professional Services Agreement Between Owner and Design Builder (DB10)

Professional Services Agreement

Between Owner and Design/Builder

ARTICLE 1. AGREEMENT

This Agreement is made effective as of [Date], by and between:

1.1 Owner:

Street Address:	*Mailing Address:*
Yale University	Yale University
Office of Facilities Construction & Renovation	Office of Facilities Construction & Renovation
2 Whitney Avenue, Eighth Floor	P.O. Box 208297
New Haven, Connecticut 06510	New Haven, Connecticut 06520-8297

and

1.2 Design/Builder:

[Name]

[Address]

[Address]

for the Services provided herein in connection with the:

1.3 The Project:

Project Name:

Project Number:

PO Number:

1.4 Mutual Assent. The submission of this unexecuted Agreement to Design/Builder shall be for examination purposes only and shall not constitute an offer, nor is the Design/Builder authorized to proceed with the Work until the Agreement is signed by both parties and such fully executed Agreement is delivered to Design/Builder by Owner. Execution of this Agreement by Design/Builder and the return thereof to Owner shall not be binding upon Owner, notwithstanding any time interval, until (i)

Design/Builder has executed this Agreement, (ii) Owner has executed this Agreement, and (iii) Owner has delivered the fully executed Agreement to Design/Builder. Design/Builder shall not rely on any oral, written or implied agreement with regard to the subject of this Agreement except to its detriment and peril.

1.5 Fiduciary Relationship. The Design/Builder accepts the fiduciary relationship of trust and confidence hereby established with the Owner, including the obligation to deal with the Owner with the scrupulous good faith, loyalty and candor that such relationship requires. The Design/Builder acknowledges that the Owner is relying on the expertise and integrity of the Design/Builder for all services hereunder. The Design/Builder shall furnish efficient business administration and superintendence and use its professional efforts to complete the Project and to achieve all of the Owner's objectives within the budget and Schedule in the most expeditious and economical manner consistent with the interest and goals of the Owner. The Design/Builder agrees to cooperate with the Owner and other persons or entities employed by the Owner in connection with the Project.

1.6 Professionalism. The Design/Builder agrees to use its professional expertise and judgment at all times to provide the Design/Builder's Services in accordance with the terms and conditions of this Agreement in furtherance of the Owner's stated goals for the Project in terms of budget, quality, scope and Schedule. The Design/Builder shall perform its Services expeditiously in accordance with the expertise, care and skill exercised by contractors, construction managers, design professionals and consultants that have successfully completed projects of comparable size and complexity.

1.6.1 The Design/Builder's representations in its proposals, during the interview process, and as published in any materials furnished to the Owner are material representations upon which the Owner has relied and the Design/Builder hereby affirms those representations as part of this Agreement.

1.7 Design/Build Team. In carrying out its responsibilities under this Agreement, the Design/Builder shall use skilled employees, Consultants and Subcontractors with proven experience in projects of comparable type, size and complexity, and holding such professional licenses or registrations required by Applicable Law. The Design/Builder's Designated Personnel, Consultants and Subcontractors assigned to the Project are set forth in Exhibit B, changes or additions to which after the execution of hereof shall be subject to the Owner's sole discretion and approval. The Design/Builder shall remove and replace any persons or entities performing the Work on behalf of the Design/Builder that are not satisfactory to Owner.

1.7.1 The Designated Personnel shall consist of the personnel directly employed by the Design/Builder and identified in Exhibit B as assigned to the Project.

1.7.2 Exhibit B includes the Design/Builder's Staffing Plan for the Work, which is the Design/Builder's good faith estimate of the level of participation required by the Designated Personnel and Consultants.

1.8 Definitions. Terms capitalized in this Agreement are defined as follows and elsewhere in this Agreement.

1.8.1 **Applicable Law.** applicable federal, state and municipal laws, statutes, regulations, ordinances, codes, rules, rulings, decisions, orders, interpretations and judgments of Governmental Authorities relating to the Services or the Work.

1.8.2 **BIM Requirements.** The Owner's Project-specific BIM requirements incorporated in the Contract Documents.

1.8.3 **Building Information Model (BIM or the BIM Model).** A digital representation of physical and functional characteristics of the Work creating a shared knowledge resource for information about it and forming a reliable basis for decisions during its life cycle. This term may be used herein to describe a component, system or assembly; a single model or multiple models used in the aggregate; and other data sets identified herein.

1.8.4 **CAD Standards.** The Owner's requirements for the format of electronic drawing files, as maintained and amended from time to time by the Owner, for the preparation, organization and transfer of Archive Drawings, Archive Assignment Plans and such other Instruments of Service as the Owner may designate.

1.8.5 **Consultant.** Any person or entity, other than the Design/Builder or Owner, that provides professional services to the Project pursuant to a direct contract, purchase order or other agreement with the Design/Builder or Owner.

1.8.6 **Construction Cost.** The amounts set forth in Article 3 of the GMP Provisions attached as an Exhibit to this Agreement.

1.8.7 **Contract Documents.** The documents consisting of this Agreement, all documents incorporated herein by reference, the Construction Proposal and all documents incorporated therein by reference (upon acceptance by the Owner as Amendment No. 1), BIM, addenda and Change Orders. The GMP Provisions attached as an Exhibit hereto shall be applicable to and binding upon the Owner and Design/Builder with respect to all portions of the Work for which the Contract Sum is not based on an agreed lump sum.

1.8.8 **Contract Sum.** The amount set forth in this Agreement, including authorized adjustments, which is the total amount payable by the Owner to the Design/Builder for performance of the Work.

1.8.9 **Contract Time.** The period of time, including adjustments by Change Order, allotted in the Schedule from the Owner's execution of the Construction Proposal until the date of Substantial Completion of the Work. The Contract Time shall be established by the procedure set forth in Article 5, and shall be contained in Amendment No. 1.

1.8.10 **Day(s).** Except as otherwise specifically stated, Day(s) shall mean calendar days. For time periods specified as less than 15 Days, Day(s) refers to business days, meaning any day other than Saturday, Sunday or days on which the offices of the State of Connecticut are not open for business. In the event that any time period hereunder ends on a day that is not a business day, the time period shall be extended to the next business day thereafter.

1.8.11 **Deliverables.** Instruments of Service, including those in electronic form, that are created, prepared or produced for the purpose of being furnished, or which are actually furnished, to the Owner as part of this Agreement, including:

.1 Plans, elevations, sections, details, schedules, diagrams, and all other graphic or pictorial depictions of the design, location and dimensions of the Work prepared by the Design/Builder, its Subcontractors and/or Consultants of all tiers; and

.2 Written descriptions of the quantitative and qualitative requirements for materials, equipment, systems, standards and workmanship for the Work.

1.8.12 **Defective Work.** Along with the terms "defect" or "defective" in reference to the Work, shall mean Work or a Deliverable, or any portion thereof, that: (1) is faulty or deficient; (2) does not conform to the Contract Documents, the directives of the Owner, or the requirements of any standard of performance, inspection, reference standard, test, code or approval specified in the Contract Documents; or (3) does not conform to Applicable Law.

1.8.13 **Direct Aggregate Project Costs (DAPC). Construction costs that include procured materials, permits and subcontracted work necessary for a complete project.**

1.8.14 **Energy Conservation Measures.** An Energy Conservation Measure is any technology implemented to reduce energy consumption of a building. The target is a net reduction in any combination of purchased utilities including electric, natural gas, fuel oil and water via savings achieved as a result of implementing the Energy Conservation Measure. The scope of projects that may be identified as an Energy Conservation Measure apply to: building envelope, HVAC infrastructure, controls, lighting systems, utilities related infrastructure, or any other modification or installation reviewed and agreed upon with Owner.

1.8.15 **Final Completion.** The point at which the entire Work is fully complete in accordance with the Contract Documents.

1.8.16 **Governmental Authorities.** Local, county, regional, state and federal governmental bodies, agencies, departments and bureaus having jurisdiction over the Services or the Work, or from whom permits, approvals or other consents are required.

1.8.17 **Instruments of Service.** Any tangible work product, including those in electronic form, BIM and drafts and reproductions of such tangible work product, prepared by or on behalf of the Design/Builder in the performance of Services or Work.

1.8.18 **Pre-Design.** Those Services provided by Design/Builder pursuant to Section 2.2 of this Agreement.

1.8.19 **Owner's Design Standards.** The Owner's requirements, as maintained and amended from time to time and made available by the Owner, for designing and building new structures and for remodeling existing structures.

1.8.20 **Project.** The entire construction project contemplated by the Owner and identified in the Contract Documents, which includes the Work, the services undertaken by the Design/Builder, its Subcontractors and Consultants and any related construction or operations by the Owner, its Consultants or Separate Contractors.

1.8.21 **Project Record Documents.** Documents, including those in electronic form and BIM prepared by the Design/Builder recording the Work as actually performed to the extent that the information differs from or supplements original Contract Documents, and marked to record changes, selections made during construction, and as-built locations of system elements. Project Record Documents include marked-up copies of Drawings and Specifications, including Design/Builder's Supplemental Instructions, Construction Change Directives, Addenda, Change Orders, all approved Submittals, field records for variable and concealed conditions, field test reports, inspection certificates, manufacturer's certificates, and final as-built BIM. Project Record Documents shall be delivered to Owner in electronic

format consistent with Owner's CAD Standards and BIM Requirements, unless otherwise requested by Owner.

1.8.22 **Project Site.** The buildings, premises and spaces on which any portion of the Work is performed or used in support of the performance of the Work.

1.8.23 **Subcontractor.** Any person or entity of any tier that provides labor, materials, equipment or construction services to the Project on behalf of the Design/Builder pursuant to a contract, purchase order or other agreement with the Design/Builder.

1.8.24 **Substantial Completion.** The point at which the entire Work, or a portion thereof designated by the Owner, is sufficiently complete in accordance with the Contract Documents for the Owner to occupy or utilize for its intended purpose without material inconvenience to the occupants.

1.8.25 **Work.** All pre-design, design, procurement, construction and performance monitoring activities and services of the Design/Builder, including labor, materials, equipment and other construction services and Deliverables to be furnished by the Design/Builder hereunder, described in the Contract Documents and such other work reasonably inferable as necessary to produce the results intended by the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

1.8.26 **Work Authorization.** Owner's written acceptance of a Pre-design Proposal, as set forth in Section 2.2.2, or Construction Proposal, as set forth in 2.3.7, to proceed with the associated work.

1.9 Interpretation of Contract Documents.

1.9.1 Captions, titles, headings, cover pages, and tables of contents contained in the Contract Documents are inserted only for convenience and in no way define, limit or describe the scope, intent or meaning of any provision of the Contract Documents.

1.9.2 In the event of conflict between or among any of the Contract Documents, the provision placing a more stringent requirement or greater burden on the Design/Builder, or requiring the greater quantity or higher quality material or workmanship, will prevail. Conflicts that cannot be so resolved will be interpreted based on the following, in descending order of priority:

.1 Change Orders, amendments and riders thereto, with those of more recent date having precedence;

.2 This Agreement;

.3 Addenda, with those of more recent date having precedence;

.4 Drawings and Specifications; and

.5 The Construction Proposals (upon acceptance by the Owner as an Amendment).

1.9.3 Unless otherwise defined in the Contract Documents, words and abbreviations that have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

.1 Unless otherwise defined herein, words and abbreviations that have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

.2 The words "include", "includes" and "including", as used in the Contract Documents, shall be deemed to be followed by the phrase "without limitation".

.3 Unless the context clearly indicates to the contrary, words such as "hereunder", "hereto", "hereof" and "herein" refer to the whole of the Contract Documents and not to any particular article, paragraph, subparagraph or clause.

.4 Anything indicated in one document but not in the others shall have the same effect as if indicated in all. Any item incorporated by reference from one section of the Specifications to another shall be included in the Work. Failure to cross-reference all applicable Specifications sections, Drawings and BIM shall not relieve the responsible party from the obligation to furnish and install such Work.

.5 Where the Contract Documents require compliance with more than one requirement with respect to any aspect of the Project, the better quality or more stringent requirement is intended.

1.9.4 With regard to any proposal or Deliverables prepared by the Design/Builder and incorporated into the Contract Documents, only the information therein that specifically relate to the scope of the Work are incorporated into and made a part hereof, to the extent not inconsistent with this Agreement or the Program, and provided that no other terms in such proposal or Deliverables shall be incorporated herein or be given any force or effect.

ARTICLE 2. SCOPE OF SERVICES

2.1 General. The Design/Builder shall furnish pre-design, design, procurement, construction and performance monitoring Services for comprehensive energy conservation measures and other scopes of work, for systems and buildings identified by the Owner in accordance with the terms and conditions of this Agreement. The Design/Builder shall perform all the Design/Builder's Work in accordance with the Contract Documents using its best skill and attention in a first-class and workmanlike manner, in observance of the best practices of the applicable professions and trades and in compliance with Applicable Law. The Design/Builder shall be solely responsible for all pre-design, design, procurement, construction and performance monitoring means, methods, techniques and procedures including the adequacy and safety thereof within the scope of the Work.

2.1.1 Owner's Existing Information. At the earliest possible date, the Design/Builder shall provide the Owner with a list of information or documentation required from the Owner that is necessary for the performance of the Work. The Design/Builder shall gather available documents from the Owner's identified record storage location(s) and shall assemble, review and coordinate it with data furnished by the Owner. Design/Builder may reasonably rely, in their professional judgment following diligent review, upon such requested information prepared and provided by Owner.

2.1.2 Program Review and Evaluation. The Design/Builder shall carefully examine the

Program and other information furnished by the Owner to ascertain the requirements of the Project, and shall provide a preliminary evaluation of the scope of the Work, schedule and budget, each in terms of the other.

2.1.3 **Coordination.** The Design/Builder shall be solely responsible for coordinating all portions of the Services and Work, including those portions performed by its personnel, Consultants and Subcontractors. In addition, the Design/Builder shall monitor information flow, decision-making, progress and reporting among itself, the Owner, the Consultants and Subcontractors to facilitate the orderly progress of the Work.

.1 The Design/Builder shall review and check all Deliverables and make modifications as necessary prior to submission to the Owner to make sure that they are integrated into a complete and coordinated set of documents, are compatible with existing conditions and the intended design, and are constructible, consistent with the Owner's goals for the Project.

.2 To the extent that any portion of the Design/Builder's obligations hereunder are interdependent upon the services or activities of the Owner or its representatives, Consultants, Separate Contractors and/or representatives, the Design/Builder shall actively coordinate with such persons or entities as necessary to fulfill its obligations hereunder.

2.1.4 **Existing Conditions.** The Design/Builder shall review the information provided by the Owner and identify investigations of existing conditions at Project Site and adjacent premises, and the conditions in which the Work is to be performed for the purpose of discovering construction difficulties and opportunities. Where non-destructive field inspections and measurements of existing conditions is needed, the Design/Builder shall make such inspections and measurements as necessary to gain a fuller understanding of the conditions affecting the Work. The Design/Builder shall recommend destructive testing beyond that which is included in the Work to determine concealed existing conditions if such conditions could impact the Contract Sum, Contract Time or safety of persons in the area.

2.1.5 **Meetings.** The Design/Builder shall prepare for and actively participate in regular meetings, at a frequency set forth in Exhibit A, with representatives of the Owner to coordinate activities, review progress, and discuss and decide issues relating to the Project. With prior notice to and approval from the Owner, the Design/Builder shall prepare documentation for and participate in meetings with boards, commissions, committees, gatherings and Governmental Authorities in furtherance of Project approval. The Design/Builder shall be represented at such meetings by persons having knowledge of the matters to be addressed and authorized to act on its behalf at all times. The Design/Builder shall record and distribute written minutes to meeting attendees within three (3) Days of each meeting.

2.1.6 **Cost Management and Estimating.** Designs proposed by the Design/Builder shall allow for efficient, simplified and practical management of operating and maintaining materials, equipment and systems, and shall otherwise provide good value to the Owner while meeting

Commented [ML1]: We propose a method that promotes more alignment of interest that includes milestones based approach. More details are presented in the Project Agreement section of our response.

the Project requirements. Upon completion of the Pre-design Phase, the Design/Builder shall prepare and submit to the Owner a preliminary estimate of the Construction Cost. The Design/Builder shall base its estimates on pricing furnished by Subcontractors expected to perform the Work, quantity takeoffs, production rates and crew structures and other methods that are commonly used to estimate lump sum competitive bids in the construction industry.

.1 Prior to the acceptance of the Construction Proposal, the Design/Builder shall prepare, maintain, monitor, refine and update its estimate of the Construction Cost and submit the estimate with its monthly reports for review and acceptance by the Owner.

.2 Each estimate shall reserve separate line items for anticipated Fees and Contingency, and shall be accompanied by a written statement of its basis, including a list of Allowances and assumptions in terms of quantity, quality and cost.

.3 The Design/Builder shall notify the Owner whenever the projected Construction Cost exceeds the budget, the latest approved estimate, or the GMP, and in such circumstances the Design/Builder shall recommend specific value enhancements as alternatives for conforming the Work to the Program and budget, which the Owner may accept or reject in its discretion.

.4 If the Owner retains an independent estimator, the Design/Builder shall meet with such estimator as necessary to review and reconcile estimates.

2.1.7 **Constructability.** The Design/Builder shall utilize design and construction practices, details and methodologies that optimize construction feasibility, efficiency in time and cost, and available labor, materials, equipment and building systems. The Design/Builder shall make recommendations to the Owner concerning the advisability of phased design and construction. The Design/Builder shall prepare and submit a logistics plan for the use of the Project Site and its surroundings and a parking plan for utilization of available on-site and off-site parking.

2.1.8 **Scheduling.** Immediately following execution of this Agreement, the Design/Builder shall prepare and submit to the Owner a Schedule that adheres to the milestone dates set forth herein, unless deviation therefrom is authorized by the Owner. Throughout the duration of the Work, the Design/Builder shall prepare, maintain, monitor, refine and update the Schedule and submit the Schedule with its monthly reports for review and acceptance by the Owner. The Design/Builder shall conspicuously identify in each Schedule update any changes from the prior Schedule.

.1 A Schedule is a diagram, graph, plot or other chart that (a) indicates the Contract Time; (b) specifies Project activities, including start dates, durations and finish dates, both completed and remaining, at a specific point in time; (c) shows milestones for Submittals, long lead-time items, phasing, work in occupied areas, portions of the Project having occupancy priority, and the key milestones set forth in Exhibit A; (d) shows the logical interconnections of individual activities to their predecessor and

Commented [ML2]: We have included an example of milestones and steps in the project agreement section as well as a sample schedule in the appendix. This process should be mutually and agreed upon during the early development of the project.

successor activities, the amount of float available to perform each activity, and the Project's critical path; (e) coordinates and integrates the activities, sequences and approvals of the Owner, Design/Builder, Consultants, Subcontractors, Separate Contractors and Governmental Authorities; and (f) is rendered in a form to make it an effective tool for planning, monitoring progress and determining the optimum sequencing of the activities to achieve the key milestones set forth in Exhibit A. Where the Contract Documents require compliance with the Schedule, such compliance shall be in accordance with the latest Schedule accepted by the Owner.

.2 The Design/Builder and Owner agree that the Work shall adhere to the milestone schedule as presented in Exhibit A. The Design/Builder shall monitor, refine, and provide updates to this overall schedule based upon Work identified within all Work Authorizations. The overall milestone schedule shall also be updated and included within each Work Authorization with all changes conspicuously identified by the Design/Builder.

2.1.9 **Recordkeeping and Reporting.** The Design/Builder shall record and maintain detailed data on the progress of the Work in terms of Schedule, costs, safety, and manpower and equipment use. The Design/Builder shall submit to the Owner monthly reports on such data as the Owner may request. The Design/Builder shall maintain detailed, organized documents and data relating to the Work until at least eight (8) years after Final Completion.

.1 If required by the Owner, the Design/Builder shall take date-stamped, digital photographs of the progress of the Work, including: (a) six (6) time-lapse site views, taken at least once per month; (b) monthly progress photographs; and (c) any critical components, assemblies or conditions prior to being covered up. The Owner may, by Change Order, require that the Construction Manager record the progress of the Work by aerial photography, videotape or other means.

2.1.10 **Standards.** The Design/Builder shall familiarize itself with the Project and the Owner's requirements and perform the Work in accordance with the Contract Documents, the Owner's Design Standards, the Owner's CAD Standards, Owner's BIM Requirements, and the Owner's standards for surveys and benchmarking and Applicable Law.

2.1.11 **Correction.** The Design/Builder shall repair or replace, as the Owner directs, Defective Work and any damage to the Work or to the work of a Separate Contractor that is caused by the Design/Builder or those for whom it is responsible. Costs associated with such repair or replacement, including additional third-party tests and inspections made necessary thereby, shall be borne by the Design/Builder.

.1 The Design/Builder shall notify the Owner promptly if it observes or is aware of a defect in the Work or an inconsistency between a requirement of the Contract Documents and corresponding field conditions, and shall include a proposal to correct such defect or inconsistency if requested by the owner.

2.1.12 **Incentives**. The Design/Builder shall provide all calculations, documentation and other Deliverables required to secure financial incentives available for the Project. It should be noted that the Owner will apply for and receive any incentives directly from the utility and not use them to offset construction cost by payment directly to contractors. The Design/Builder shall provide Owner with live energy savings spreadsheets and software model files as applicable. Owner will enter into a non-disclosure agreement to protect proprietary software.

Commented [AR3]: DB should be tied to actually obtaining incentives vs tied to process

2.2 Pre-Design Phase. Upon execution of this Agreement, the Owner shall identify systems and/or buildings for the Design/Builder to perform the Services necessary to produce the Deliverables required in this § 2.2. The Design/Builder shall not proceed with any other Services without specific written authorization from the Owner, and Owner shall have no obligation to compensate the Design/Builder for Services undertaken but not authorized.

2.2.1 Design/Builder shall issue a Time & Expense based, Not-to-Exceed investigation proposal upon assignment, based on billing rates established in Exhibit B. Proposal shall include investigation work scope and schedule. Agreement with Owner shall be obtained on scope, schedule, and cost before proceeding. Proposal shall be in a format acceptable to Owner. Note that any subcontracted investigative activities required to complete investigations shall be funded as a separate construction proposal as detailed in 2.4, which may include but not be limited to the following activities:

Commented [AR4]: Why be incentivized to spend time monitoring expenses and timesheet vs going flat fee and making sure we are both tracking highest NPV project to be incentivized to collaborate to come up with best projects?

(a) Submetering
(b) Lab airflow verification
(c) Testing & balancing
(d) Fume hood reviews
(e) Infiltration tests
(f) BAS trending & programming support **(g)** All other vendor supported equipment tests.

2.2.2 **Analysis.** Design/Builder shall conduct appropriate investigation activities as described in proposal which may include the following (and such other activities as reasonably requested by Owner): Evaluate building automation system scheduling, setpoints, sequences, and configuration; set up building automation system trending as required; install local metering and monitoring to support analysis as necessary; conduct a survey of building performance and conditions during occupied hours, as well as low-occupancy and no-occupancy hours; and review capital projects that are in progress or planned for each building.

2.2.3 **Reporting**. Design/Builder shall prepare concise reports for each investigation, summarizing:

.1 System and/or Building energy performance and key characteristics;
.2 Energy auditing activities, including times, dates, and participants, systems reviewed, documents reviewed;

.3 Comprehensive list of Energy Conservation Measures or other scopes of work and alternatives considered;

.4 Focused list of scopes of works deemed suitable for formulation; including written scope descriptions with alternatives identified as applicable, system diagrams and drawings as required to effectively convey the anticipated scope of work, estimated costs for each measure, available utility incentive, estimated energy savings for each measure, and estimated energy savings for the combined portfolio of measures within the building;

.5 Applicable calculations, assumptions, and estimations;

.6 Cost estimates for the Work to be implemented (Design/Builder shall conduct contractor walk-throughs and obtain vendor quotes to better inform cost estimates as necessary); and

.7 Recommendations on which scopes of work to pursue.

2.3 Design Phase. Upon issuance of a Notice to Proceed, the Owner will authorize the Design/Builder to perform the portions of the Services described, and the Services reasonably necessary to produce the Deliverables required, in this § 2.3. The Owner may elect to proceed with all, some or more of the Design/Builder's recommendations. Prior to the Owner authorizing the Design/Builder to proceed with recommended scopes of work, the parties shall agree on an estimated Direct Aggregate Project Cost (DAPC) to implement the work. The Design/Builder shall not proceed with any recommendations not authorized by Owner, or other portions of the Services without specific, written authorization from the Owner, and the Owner shall have no obligation to compensate the Design/Builder for Services undertaken but not authorized. The Services in this Phase shall be broken down into three separate milestones – 50% Construction Documents; 90% Construction Documents; and 100% Construction Documents. The obligations and requirements of each milestone are set forth in Exhibit A. In addition to the requirements set forth in Exhibit A, the Designer/Builder shall be responsible for the following:

2.3.1 Analysis of Alternatives. The Design/Builder shall consider, evaluate and recommend alternative approaches to any scope of work, including systems, equipment and components thereof, for the purpose of maximizing the Owner's objectives for quality, performance, Schedule and Construction Cost.

2.3.2 Meetings. The Design/Builder shall meet with Owner to review the design, and provide its recommendations regarding approach to the selected Energy Conservation Measures, at a frequency set forth in Exhibit A.

2.3.3 Design Documents. The Design/Builder shall prepare and submit, at a minimum, a proposed re-stated Program and those Deliverables as specified in the attached exhibit and as specified herein that identify and establish detailed design criteria and the scope of the Work. The Design/Builder shall conspicuously identify in such Deliverables any deviations from the Program or previously submitted Deliverables.

Commented [AR5]: This encourages waste vs more frequent Touchpoint /milestones to discuss progress, or opportunities in a more collaborative way and avoid spending precious engineering time on reports that will sit on shelves. Less time reporting on non-actionable items is key here. And it's all about collaboration as our expertise needs to be matched to Yale's staff deep knowledge of their buildings, challenges and opportunities.

Commented [AR6]: All authorizations need to be part of a redesigned milestone progression scheme as per A 1.5 Also our view is that NPV would make for a better tool to look at project value through lifecycle cost analysis. We would recommend DAPC/NPV to 50% design and then going lump sum to share program risks and align interests, vs just having a license to spend money.

.1 The Design/Builder shall record, evaluate and submit responses to comments received from the Owner or Governmental Authorities in terms of value management, redesign, improvement and correction of Defective Work for subsequent incorporation into the design. If required by the Owner to attain the necessary level of completeness or to correct Defective Work, the Design/Builder shall modify and resubmit the Deliverables.

.2 The Design/Builder shall not begin to prepare Construction Documents without the Owner's written authorization.

2.3.4 **Program Review and Evaluation**. Before proceeding to Construction Documents, the Design/Builder will re-confirm the Project scope, Schedule and latest estimate for the selected Energy Conservation Measures. The Design/Builder will meet as needed with the Owner and its designees to confirm the Owner's needs with respect to aesthetic, functional, time, financial and other design-related requirements.

2.3.5 **Construction Documents.** Upon written authorization from the Owner, and based on the approved design documents, the Owner's comments and any adjustments to the Program, Schedule or estimates, the Design/Builder shall prepare and submit, at a minimum, a proposed re-stated Program and those Deliverables specified herein that establish and describe the final scope, relationships, forms, size and appearance of the Work. Such Deliverables shall be detailed, coordinated, constructible, complete, accurate, and suitable for obtaining permits, bidding and constructing the Work. The Design/Builder shall conspicuously identify in such Deliverables any deviations from the Program or previously submitted Deliverables.

.1 The Design/Builder will analyze, update and coordinate its Services and Deliverables as necessary to prepare and submit, at or prior to the times indicated in the Schedule, Construction Documents at 50% completion and 90%, all as set forth in more detail in Exhibit A, and to respond to questions from the Owner and its designees. The Design/Builder will make additional changes as required to complete the Drawings and Specifications as 100% Construction Documents for inclusion in the bid packages for the selected scope of work.

.2 The Design/Builder shall record, evaluate and submit responses to comments received from the Owner or Governmental Authorities in terms of value management, redesign, improvement and correction of Defective Services for subsequent incorporation into the design. If required by the Owner to attain the necessary level of completeness or to correct Defective Services, the Design/Builder shall modify and resubmit the Deliverables.

.3 The Design/Builder shall incorporate all requirements for performance management in Construction Documents including necessary trending, reporting, training, and review to demonstrate and maintain system and/or building energy performance.

Commented [AR7]: This is inherent to a good outcome-based agreement with regular milestones to keep collaboration throughout.

Commented [ML8]: The approach we have proposed focuses on collaboration, transparency and delivering results. In order to achieve this, the construction process must be agile.

Commented [AR9]: Core to innovation is the idea of being able to move fast and fail. And adjust, without having to spend more time on paper than on piping…

2.4 Procurement and the Construction Proposal. The Design/Builder shall not commence any Procurement Phase Work without specific written authorization of the Owner. Upon the Owner's written authorization, the Design/Builder shall proceed expeditiously to perform the Work set forth in § 2.4.1.

2.4.1 Procurement. The Design/Builder shall submit a list of recommended bidders for scope of work to the Owner for review and comment, and shall disclose any relationship, ownership or interest in any bidders. The Owner may in its sole discretion add and remove potential bidders from the Design/Builder's list or expressly reject bidders following the receipt of bids. If such rejection follows submission of the Construction Proposal, the Design/Builder shall be entitled to an equitable adjustment in the Construction Proposal, or in the Contract Sum and Contract Time.

.1 The Design/Builder shall prepare integrated bid documents that are complete, ready for bid and calculated to foster highly competitive bidding of all aspects of the Work, and to eliminate scope gaps and jurisdictional disputes among trades.

.2 The Design/Builder shall contemporaneously copy the Owner on all clarifications and addenda issued to bidders.

.3 The Design/Builder shall coordinate and attend a conference at the Project Site to familiarize prospective bidders with local conditions affecting the Work, safety requirements, the Schedule, Project procedures and policies, any special systems, materials or methods, and other agenda items required.

.4 After the opening of the bids, the Design/Builder shall hold mandatory scope review meeting(s) with bidders and determine whether the bids are complete, responsive and without unacceptable qualifications. The Design/Builder shall provide the Owner with its written analysis of the bids, recommend bidders to whom it intends to awarded subcontracts and request the Owner's authorization to do so.

(a) The Design/Builder's analysis also shall identify any proposed substitution, summarize its impact on the Construction Cost and the Schedule, and compare it with the specified products, materials or equipment. If the Design/Builder recommends a bidder other than the apparent low bidder, it shall include the basis for its recommendation in its analysis.

2.4.2 Construction Proposal. When the Deliverables are sufficiently complete for selected Energy Conservation Measures, the Design/Builder shall prepare and submit to the Owner a Construction Proposal in the form attached as Exhibit D to perform the Work associated with the selected Energy Conservation Measures on the basis of a Construction Cost plus Fee.

.1 Any Construction Proposal shall set forth, include and be based upon:

(a) The proposed Control Estimate (as defined in § 6.1.2.3) to perform all Work for the selected Energy Conservation Measures, including:

(i) the estimated Construction Cost, broken down by trade (and based on actual bids, if any, received

Commented [AR10]: Procurement should be transparent and collaborative but without having to tell the DB-er how to do it.

Commented [ML11]: In the Project Agreement Section, we have suggested a lump sum proposal established collaboratively with the Yale at 50% design with items (a), (b) and (c) with an NPV analysis of lifecycle costs and other critical outcomes that the Yale wishes to obtain through the project.

prior to submission of the Construction Proposal);

(ii) the Contingency; and **(iii)** the Construction Fee.

(b) The documents describing all Work to be performed, including a list of all Deliverables and addenda;

(c) The Schedule, clearly setting forth the Contract Time;

(d) A statement of all alternates, Allowances, unit prices, clarifications and assumptions;

(e) An updated list of Designated Personnel, Consultants and Subcontractors, with a detailed written explanation of the cause of any variances from those set forth in Exhibit B;

(f) An accounting setting forth the agreed adjustment to the Design and Procurement Phase Fee, based on the difference in the estimated Construction Cost from the initial estimate to the Construction Proposal, as required by § 6.1.1.3;

(g) A report setting forth the required shut-downs and a recommended course of action associated with the required shut-downs; and

(h) Any other information requested by the Owner to evaluate the Construction Proposal.

.2 Upon the receipt and after evaluation of the Construction Proposal, the Owner may accept, reject, or negotiate it with the Design/Builder. If the Owner accepts the Construction Proposal or a modified version thereof, then it shall be set forth as Amendment No. 1 to this Agreement.

2.5 Construction Phase. The Design/Builder shall not award a subcontract or commence any Construction Phase Work without specific written authorization of the Owner to do so. Upon the Owner's written authorization, the Design/Builder shall award subcontracts and commence and proceed expeditiously to execute the entire Work in accordance with the Contract Documents based on the Schedule.

2.5.1 Prosecution of the Work. The Design/Builder shall be solely responsible for and have control over construction means, methods, safety, techniques, sequences and procedures and for coordinating all portions of the Work.

.1 The Design/Builder may make substitutions to products, materials and equipment referenced in previously submitted Deliverables, or required under the Contract Documents, only with the prior, written consent of the Owner and in accordance with a Change Order.

.2 Before starting each portion of the Work, the Design/Builder shall carefully study and compare the various Contract Documents and information furnished by the Owner relative to that portion of the Work, take field measurements and observe any conditions at the Project Site affecting it.

.3 Unless otherwise provided in the Contract Documents, the Design/Builder shall provide labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

.4 The Design/Builder shall not unreasonably encumber the Project Site with tools, materials, equipment or waste, and shall remove all such items at completion of the Work, except as otherwise required by the Contract Documents.

.5 The Work shall not interfere with continuous and safe operation of the buildings and Project Site. If interference appears possible, the Work involved must be done at a time and in a manner agreed upon by the Owner to reduce such interference. The Design/Builder shall provide the Owner with reasonable notice prior to Work that will impact the use of public and occupied areas, including providing a detailed description of proposed activities and suggestions for minimizing or eliminating any impact on the use of the space.

2.5.2 **Permits.** The Design/Builder shall apply for, secure, maintain, comply with and renew building permits, licenses and certificates of inspection, use and occupancy, all as necessary for proper execution and completion of the Work. The Design/Builder shall give and maintain records of all notices incidental to the lawful performance of the Work, and shall deliver same to the Owner before the Final Completion of the Project.

2.5.3 **Safety.** The Design/Builder shall at all times take every reasonable precaution against injuries to persons or damage to property at the Project Site. The Design/Builder shall prepare a safety plan in accordance with Owner's Contractor Health and Safety Guidelines, as amended from time to time. The Design/Builder shall comply with, and shall ensure that its Consultants and Subcontractors of all tiers agree to comply with, the safety plan. Any person in violation of this Paragraph section is subject to dismissal at the Owner's discretion.

.1 The Design/Builder shall immediately notify the Owner of any accident at the Project Site resulting in bodily injury or damage to any property regardless of cause or extent of any bodily injury or damage to property. The Design/Builder shall promptly investigate the circumstances surrounding the accident, including the nature and extent of any injuries or property damage and the names of all witnesses, and shall notify the Owner in writing of such accidents by the close of the next business day following their occurrence.

.2 When the use of explosives, blasting, pile-driving, heavy equipment, vibrationproducing equipment and similar materials, equipment or methods at the Project Site is necessary for the execution of the Work, the Design/Builder shall exercise the utmost care. The Design/Builder shall promptly remedy property damage resulting from the use of such materials, equipment or methods by them or those for whom they are responsible and shall indemnify, defend and hold harmless the Owner, its agents, officers, trustees, directors, representatives and employees from and against all claims, damages, losses, liabilities, obligations, costs, fines, penalties and expenses, direct, indirect or consequential (including fees and charges of engineers, architects, attorneys and other professionals and court and dispute resolution costs) arising out of or resulting from the performance or lack of performance of such services, to the extent caused by an act or omission by the Design/Builder or anyone for whose acts or omissions it may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder (with the exception only for any negligence that is prohibited from the scope of this clause by Applicable Law).

.3 In the event of an emergency affecting safety of persons or property, and only until such emergency ceases to exist, the Design/Builder shall immediately take such action without authority or instruction from the Owner as may be reasonable and necessary under the circumstances to prevent threatened damage, injury or loss. The Design/Builder shall notify the Owner of such emergency as promptly as is practicable under the circumstances, but in no event more than 24 hours after such emergency.

(a) The Owner may immediately take such action as may be reasonable and necessary under the circumstances to prevent threatened damage, injury or loss.

2.5.4 Hazardous Materials. A Hazardous Material is any pollutant, hazardous or toxic substance, waste or material, including oil products, mold, asbestos, asbestos-containing material, lead, lead-containing material, urea formaldehyde foam insulation, transformer or other equipment that contains dielectric fluid-containing polychlorinated biphenyls, flammable explosives, radioactive materials or any other material or substance designated or regulated as hazardous or as a toxic substance or waste, pollutant or contaminant under Applicable Law.

.1 If the Design/Builder knows or becomes aware of Hazardous Materials at the Project Site that were not identified in the Contract Documents, it shall immediately stop Work in the affected area and report the condition to the Owner. The Owner shall arrange for testing in the affected area and, if necessary, may direct the Design/Builder to arrange for the removal or safe containment of such material or substance.

(a) The Design/Builder will indemnify and hold harmless the Owner, its agents, officers, trustees, directors and employees from and against all claims, damages, losses and expenses, including reasonable attorneys' fees and the costs of testing, abatement, removal, remediation or containment, in addition to fines or monetary

penalties imposed by federal, state or local authority as a result thereof, arising out of or resulting from a Hazardous Material introduced to the Project Site by the Design/Builder and those for whom it is responsible in the performance of the Work

(b) The Owner will indemnify and hold harmless the Design/Builder from and against claims, damages, losses and expenses, including reasonable attorneys' fees, arising out of or resulting from the discovery of Hazardous Building Materials or Yale Hazardous Materials (as defined in the Owner's Health & Safety Guidelines) pre-existing on the Project Site, whether previously known or unknown, except to the extent caused by the negligence, intentional act, or failure to comply with the Agreement, including the failure to protect against disturbance of known hazardous materials, by such indemnitee or those for whom it is responsible.

2.5.5 **Required Tests and Inspections.** If testing or inspection of a portion of the Work is required by Applicable Law or by specific request of the Owner in writing or in the Contract Documents, the Design/Builder shall schedule and coordinate such testing and inspection. The Owner shall directly retain and compensate all required third-party testing and inspection entities unless specifically assigned to the Design/Builder in the Contract Documents. The Design/Builder shall give the Owner at least five (5) Days written notice when such portions of the Work are ready for testing or inspection, and of the date fixed for any third-party testing or inspection of such portions of the Work. If Work for which testing or inspection was required or requested is covered before such testing or inspection is performed, costs associated with uncovering and re-covering the Work for the purpose of performing such testing or inspection shall be borne by the Design/Builder.

2.5.6 **Submittals.** The Design/Builder shall confer with the Owner and agree upon a schedule of required Submittals for the Owner's acceptance. The Design/Builder shall incorporate required Submittals into its Schedule, allowing the Owner a reasonable time for review and acceptance. No portion of the Work for which a Submittal is required shall be fabricated, manufactured or constructed until the Owner has accepted the respective Submittal.

Commented [ML12]: Submittals shall be made available for review by the Yale team. The project development, sub-contractor selection and equipment selection will all be conducted in a collaborative manner.

.1 A Submittal is any graphic or written description by the Design/Builder or its Consultant or Subcontractor of any tier that demonstrates the manner in which the Work is proposed to be furnished in conformance with the Contract Documents, including:

(a) Shop drawings, diagrams, schedules and other data specially prepared for the Work to illustrate some portion of the Work;

(b) Illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other product data furnished to illustrate materials or equipment for some portion of the Work; and

(c) Physical samples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

.2 Presentation of a Submittal for the Owner's review shall constitute a representation that the Design/Builder has examined all materials, field measurements and field construction criteria related thereto, and that it has checked the Submittal for dimensional accuracy and coordination with the Contract Documents and all contiguous or independent Work. Any intended deviation from the requirements of the Contract Documents shall be conspicuously identified. Review of Submittals by the Owner shall not constitute acceptance of deviations not conspicuously identified or otherwise relieve the Design/Builder of its responsibilities hereunder.

(a) The Owner may rely upon professional designs and certifications of performance characteristics of materials, systems or equipment that are provided in Submittals.

(b) Portions of the Work for which a Submittal is required shall be fabricated, manufactured and constructed in accordance with the respective accepted Submittal.

(c) Review and approval of Submittals will not relieve submitting entities of their responsibility to verify all dimensions, field conditions and measurements, to coordinate with adjoining work and otherwise comply with the Contract Documents.

2.5.7 **Federal/Utility Incentives**. Design/Builder shall assist Owner in securing all utility and/or federal incentives or tax credits, which result from the performance of the Work, and shall facilitate, obtain and provide all necessary documentation and inspections from utilities in order to receive incentives. Any incentives secured by Design/Builder shall be for the Owner's exclusive use in Owner's sole discretion.

2.5.8 **Substantial Completion.** The Design/Builder shall notify the Owner in writing at least twenty (20) Days before the Work, or designated portion thereof, is anticipated to be Substantially Complete, and will include (a) an initial punchlist organized by area and room, (b) a work list of items remaining to be completed, and (c) a list of any actions by the Owner that are necessary to obtain approvals from Governmental Authorities to occupy the Project.

.1 On or before the proposed date of Substantial Completion, and as a condition precedent to Substantial Completion, the Design/Builder shall:

(a) proceed expeditiously to complete the items on the initial punchlist and work list;

(b) complete and test telecommunications connections and terminations;

(c) perform final clean-up, including touch-up of marred surfaces;

(d) coordinate final changing of cores by the Owner, and notify the Owner's personnel as to change in security;

(e) discontinue (or change-over) and remove temporary site facilities, services, equipment, tools, mock-ups and similar elements;

(f) complete preliminary commissioning, and training of operations personnel, in accordance with the commissioning plan; and

(g) submit the following documents to the Owner:

(i) test logs, certificates and minutes of system start-ups or other final tests required to be witnessed by the Owner, its Consultants or Governmental Authorities;

(ii) operation and maintenance manuals;

(iii) items included as part of the warranty requirements;

(iv) reports, Deliverables and other documentation required under the Contract Documents to be submitted to the Owner upon completion; and

(v) certificate(s) of occupancy, temporary certificate(s) of occupancy, and any other documentation provided by Governmental Authorities.

2.5.9 **Final Completion.** No less than ten (10) Days before the Work is fully complete, the Design/Builder shall notify the Owner of the proposed date of Final Completion. Prior to such proposed date, and as a condition precedent to Final Completion, the Design/Builder shall complete the following, notifying the Owner of known exceptions, if any:

.1 Complete the following, notifying the Owner of known exceptions, if any:

(a) Items on the punchlist and/or identified by the Owner as remaining to be completed;

(b) Final clean-up, including touch-up of marred surfaces;

(c) Delivery of attic stock, spare parts, extra stocks of materials and similar physical items to the Owner;

(d) Start-up testing of systems and instruction of the Owner's operating/maintenance personnel;

(e) Any commissioning of systems that is required by the scope of the Work; and

(f) Discontinuance (or change-over) and removal of temporary site facilities, services, equipment, tools, mock-ups and similar elements. **(g)** Furnish the following documents to the Owner:

(i) Copy of the punchlist, indicating that each item has been completed;

(ii) Project Record Documents, in accordance with the Contract Documents and BIM Requirements, with a transmittal letter containing the date, the Project title, the Design/Builder’s name and address, and a list of included documents;

(iii) Operation and maintenance manuals, digital copies of all progress and final photographs, specific warranties, workmanship/maintenance bonds,

maintenance agreements, final certifications and other documents specified in the Contract Documents to be provided to the Owner;

(iv) Final releases and lien waivers, in Owner's form available at https://facilities.yale.edu/contractors-consultants, from the Design/Builder and its Consultants and Subcontractors for labor, services, materials or equipment furnished to the Project; and **(v)** Consent of all sureties to final payment.

(vi) Archive Documents in .PDF electronic format, consisting of an entire set of drawings, specifications and assignment plans, updated to incorporate all applicable modifications issued during construction and all applicable modifications recorded on the Project Record Documents, in accordance with the Owner's CAD Standards and BIM Requirements.

2.5.10 Representations and Warranties. The Design/Builder represents and warrants to the Owner that labor, materials and equipment furnished under the Contract Documents will be of the type and quality required by the Contract Documents, new (unless otherwise required or permitted by the Contract Documents), installed in a workmanlike manner and otherwise in accordance with the Contract Documents, and that the Work will be free from defects not inherent in the quality required or permitted. The Design/Builder shall obtain and deliver to the Owner any specific warranties given by Subcontractors and those for whom they are responsible, which warranties shall expressly provide that they are for the benefit of and enforceable by the Owner.

.1 Except when a longer period is specifically required by the Specifications or Applicable Law, all warranties shall be for a period of no less than twelve (12) months from Substantial Completion. For portions of the Work that require commissioning per the Specifications, the warranty period shall be no less than fifteen (15) months from Substantial Completion If, within such period(s), the Work is found not to be in accordance with the representations and warranties herein, the Design/Builder shall promptly repair, replace or re-execute such Work at no additional expense to the Owner. Warranties shall be in form and content acceptable to the Owner.

.2 The warranties provided hereunder exclude damaged or defective work caused by modifications not performed by the Design/Builder, or by abuse, improper or insufficient maintenance, improper operation or normal wear and tear and normal usage.

2.6 Performance Monitoring Phase. Following the substantial completion of scope of work, the team shall monitor performance and achievement of energy savings.

.1 Analytics: Owner utilizes Clockworks Analytics to monitor various equipment and systems on campus including within the buildings in the scope. Design/Builder shall propose an appropriate expansion of Clockworks or alternative approach to monitor performance for a minimum of one-year post completion. It is expected that the Design-Builder will monitor Clockworks Analytics and provide periodic reports to

Owner detailing findings and overall performance of systems and equipment within the buildings in the scope.

.2 This phase shall be viewed as a "continuous commissioning" period as well as verification of performance. Any design or construction issues identified during this period shall be addressed to full resolution by the Design/Builder. It is understood that some issues identified may require extension of warranties after deficiencies are rectified.

.3 Performance Monitoring will only be applicable to measures deemed necessary by the Owner and may not be performed for all scopes of work.

Commented [ML13]: The length of post-performance monitoring should be discussed and agreed upon during the pre-design phase of the project.

ARTICLE 3. CONSULTANTS AND SUBCONTRACTORS

3.1 Management. Unless otherwise approved by the Owner, the Design/Builder will use Consultants and Subcontractors procured in accordance under written, lump-sum contracts to perform the Work. The Design/Builder will be responsible for, coordinate and have full directing authority and control over all activities of its representatives, agents, employees, Subcontractors and Consultants.

Commented [ML14]: While we typically use lump-sum contracts with out subcontractors, some subcontractors and consultants utilize a time and material approach. The Design/Builder should have authority over subcontractors contracts.

3.2 Required Provisions. The Design/Builder shall require its Subcontractors and Consultants to be bound by the terms of the Contract Documents, and to assume toward the Design/Builder all the contractual obligations and responsibilities that the Design/Builder has assumed toward the Owner. The Contract Documents shall control in the event of conflicts or discrepancies between agreements with Subcontractors or Consultants and the Contract Documents.

3.2.1 The Design/Builder shall not limit or waive rights or remedies against, or the liability of, any of its Subcontractors or Consultants, by agreement or otherwise, unless such limitation or waiver is expressly authorized in advance, either in a writing signed by the Owner or in the Contract Documents. Any unauthorized limitation or waiver of such rights or remedies shall be void, notwithstanding any terms to the contrary in such contract.

3.3 Conditional Assignment. The Design/Builder hereby assigns, transfers and conveys to the Owner all of its right, title and interest in and to any subcontract or consulting agreement for a portion of the Work or services pertaining to the Project. Such assignment shall become enforceable only after a termination of this Agreement, and only as to those agreements that the Owner expressly accepts by written notification. Any agreements assigned to, and accepted by, the Owner in accordance herewith may, in turn, be assigned by the Owner, in its sole discretion, without recourse to any person or entity, in which event such assignee shall assume the Owner's rights and obligations under the subcontract or consulting agreement.

ARTICLE 4. OWNER

4.1 Program. Attached as an Exhibit hereto is the Program setting forth the Owner's programmatic goals, objectives and requirements for the Project, and describing the scope, character, quality levels, performance standards, relationships, forms, size and appearance of the Work. The Program may include

budget and time criteria, a conceptual design approach for relevant building systems, flexibility and expandability requirements, possible sequencing, site requirements and an existing facilities assessment.

4.2 Designated Representative. The Owner's Designated Representative(s) for the Project shall be set forth in the Program. The Owner shall inform the Design/Builder when any changes affecting the designation are made. Except as otherwise expressly provided in the Contract Documents, the Owner's Designated Representative(s) are authorized to make decisions on behalf of the Owner with respect to the Project.

4.3 Owner's Existing Information. The Owner shall make available such surveys and reports that are known by the Owner to be in its possession and are readily available to the Owner's Designated Representative describing the physical characteristics, hazardous materials, geotechnical investigations, boundaries, topography, legal limitations, setbacks, easements, rights of way, and utility locations of the Project. The Design/Builder shall notify the Owner promptly if it observes or is aware that a portion of the design is at variance with the existing conditions, whether or not described in the information provided by the Owner.

4.4 Owner's Right to Audit. At any reasonable time and location, during or after completion of the Work, the Design/Builder shall grant access to the Owner and its designee(s) to inspect, audit and copy its documents, data, records and files, electronic or otherwise, relating to the Project. This audit right shall apply to all portions of the Work for which the Contract Sum is not based on an agreed lump sum. The audit of Work performed on the basis of agreed-upon rates or unit prices shall be limited to confirmation of quantities and proper application of such rates and unit prices.

4.5 Separate Contractors. The Owner reserves the right to perform other work, pursuant to a direct contract with the Owner, in connection with the Project using Separate Contractors and to let separate contracts in connection with work on adjoining sites. The Design/Builder shall accommodate for the work of Separate Contractors in the performance of the Work, including by providing Separate Contractors reasonable opportunity for storage of their materials and equipment and performance of their activities.

4.6 Disruption of Work. The Design/Builder shall reimburse the Owner for costs incurred to Separate Contractors due to failures of coordination, delays, improperly timed activities or Defective Work (except to the extent that such Work was required by the Program). The Owner shall be responsible to the Design/Builder for costs incurred because of delays, improperly timed activities, damage to the Work or defective construction of a Separate Contractor.

ARTICLE 5. TIME

5.1 TIME IS OF THE ESSENCE. The Design/Builder acknowledges that time is of the essence of the Agreement to the Owner. The Design/Builder shall proceed expeditiously with adequate forces to complete the design within the time established in § 1.4 and to achieve Substantial Completion and Final Completion of the Work within the Contract Time and in accordance with the Schedule.

5.2 Progressing the Schedule. The Design/Builder shall actively manage the progress of the Work for conformance with the Schedule and shall promptly advise the Owner of any delays, reasonably

anticipated delays and any other actual circumstances that may prevent the Project from being completed within the Contract Time and Contract Sum.

5.2.1 The Owner's review and acceptance of Schedules does not: (a) indicate agreement with or responsibility for the completeness and feasibility of such Schedules for meeting the Project requirements; or (b) relieve the Design/Builder of its sole responsibility to complete the Work within the time allowed; or constitute approval of adjustments in the Contract Time or the Contract Sum, if any, depicted or assumed in such Schedules.

5.2.2 When updating the Schedules, the Design/Builder shall promptly develop mitigation measures and recommend to the Owner affirmative plans to overcome any actual or reasonably anticipated delays, regardless of responsibility, that threaten a key milestone. The Design/Builder shall identify all cost impacts to the Work associated with such measures.

5.2.3 The Owner shall not be responsible for costs that could have been avoided by reasonable means, including backcharging responsible parties, prudent scheduling of the Work, supplementation of labor or equipment, judicious use of overtime or proper administration of Consultants and Subcontractors.

5.2.4 Without limiting other rights it may have hereunder, the Owner may direct the Design/Builder to take such action, including adding, increasing or supplementing the workforce, the number of shifts, the days of work and/or overtime operations, as necessary to minimize threatened delays to the required date of Substantial Completion, and the Design/Builder shall adjust the Schedules on account of such directives. The Contract Sum may be adjusted on account of such acceleration, except to the extent that the acceleration is due to a delay that is not compensable or concurrent, as set forth in this Article, and provided that the Design/Builder has complied with the Contract Documents by providing notice and used professional efforts to mitigate all delays and disruptions that may accrue and has submitted a change request.

5.3 Compensable Delay. If the Design/Builder is delayed at any time in the commencement or progress of the Work by any wrongful act or neglect of the Owner or Separate Contractors, by a *force majeure* event identified in § 7.5, or by a change or suspension ordered in the Work, such delay shall be considered compensable and the Contract Time and/or Contract Sum shall be adjusted by Change Order, provided that the Design/Builder has complied with the Contract Documents and submitted a change request.

5.3.1 Any change request seeking an extension of the Contract Time for a Compensable Delay shall contain: (i) a detailed description of the nature of each cause of delay; (ii) the date or dates upon which each cause of delay began and ended (as known or as projected); (iii) the number of days of delay attributable to each such cause; (iv) the impact of such delay upon the Schedule; (v) the Schedule in effect at the start of the delay; (vi) a schedule analysis of the impact of the delay on the Schedule; (vii) any proposed adjustment to the Contract Time; and (viii) such other supporting data that the Owner may reasonably request.

5.3.2 Any change request seeking an extension of the Contract Time based on severe weather shall also contain data from the National Weather Service showing that such weather was abnormal for the area and period of time in question and was not reasonably foreseeable.

5.4 Inexcusable Delay. The Design/Builder shall not be entitled to an adjustment of the Contract Time or Contract Sum for delays resulting from causes other than those listed as compensable under § 5.3, for delays that it could have avoided or mitigated using its best efforts, or for delays that do not extend Substantial Completion of the entire Work.

5.5 Concurrent Delay. If an Inexcusable Delay occurs concurrently with a Compensable Delay, either of which would have delayed Substantial Completion, the Design/Builder shall be entitled to an adjustment of time for the period that the delays are concurrent, but not to additional compensation on account of losses arising from the circumstances that caused the delay, including lost productivity, impact and inefficiency.

5.6 Delay Damages. The Design/Builder's sole remedy for a Compensable Delay is an extension of time as provided herein and additional direct costs resulting from the impacted Work. The Design/Builder and anyone claiming through it shall not be entitled to additional compensation or reimbursement, including Fee, overhead and profit, which are hereby expressly waived.

ARTICLE 6. COMPENSATION AND TERMS OF PAYMENT

6.1 Compensation. Except as modified by Change Order, the Design/Builder's compensation for the Work shall consist only of the amounts set forth herein.

6.1.1 Pre-Design Phase. The Design/Builder's compensation for Work performed during predesign shall be set forth in Exhibit C and as follows.

.1 Investigations. Fee shall be based on a Time & Expense, Not-to-Exceed letter proposal and shall include Reimbursable Expenses unless otherwise indicated above.

.2 Pre-Design scopes of work. Work that is necessary to perform to support investigation shall be compensated via a construction proposal as specified in 6.1.4

6.1.2 Design Phase. The Design/Builder's compensation for Design services performed prior to the acceptance of the Construction Proposal shall be set forth in Exhibit C and as follows.

.1 Design Phase. Fee shall be based on a percentage of the estimated DAPC that is mutually agreed upon between the Owner and Design-Builder. Upon Owner's acceptance of a Construction Proposal for Owner-selected scopes of work, the Design/Builder's Fee for such design Services shall be adjusted in the construction proposal to reflect the percentage based on the actual Construction Cost set forth in the Construction Proposal for the selected scope of work.

.2 If the Construction Proposal includes direct costs that exceed the Design-Builder estimate by more than 30% and the Owner elects to not pursue the project, the Design/Builder shall receive 50% of fee for the Design Phase. Yale shall be notified in writing upon receipt of bids that exceed estimates.

Commented [ML15]: We have proposed a lump-sum fixed fee approach for the pre-design phase. The focus should be on achieving the performance requirements and goals of the Program rather than counting hours. More details are presented in the Project Agreement Section.

.3 If the Owner elects to reduce the scope after completion of the design, the Owner shall pay the Design/Builder for all Services based upon percent of design completed, using the initially agreed upon estimated DAPC as the basis for the fee.

6.1.3 Procurement Phase. The Design/Builder's compensation for Work performed to procure equipment and services shall be set forth in Exhibit C and as follows.

.1 Procurement Phase. Fee shall be based on a percentage of the estimated DAPC that is mutually agreed upon between the Owner and Design-Builder. Upon Owner's acceptance of a Construction Proposal for Owner-selected scopes of work, the Design/Builder's Fee for such Procurement Services shall be adjusted in the construction proposal to reflect the percentage based on the actual Construction Cost set forth in the Construction Proposal for the selected scope of work.

6.1.4 Construction Phase. The Design/Builder's compensation for Work on selected scopes of work shall be set forth in Construction Proposals, which, upon acceptance by the Owner, shall be incorporated as Amendments to this Agreement. The Design/Builder's compensation during the Construction Phase shall be based on a Construction Cost plus a percentage Fee (implementation and direct markup) as set forth in Section 6.1.

6.1.2.1 The Construction Cost shall include the costs reasonable and necessarily incurred by the Design/Builder in the proper performance of the Work in accordance with the express terms of this Agreement. All Construction Costs are to be billed without additional markup, margin, or construction. During the procurement of subcontracts, the Design/Builder shall request bids for the Work in a manner so as to avoid unnecessary multiple tiers of profit and overhead. The Construction Cost shall include only payments made to Subcontractors, Consultants, and material and equipment suppliers in accordance with approved contracts let in consideration with the Project. All other costs incurred by the Design/Builder, including its general conditions, field office expenses, insurance, licenses, permits and other miscellaneous costs, are to be inserted in the percentage Fee.

6.1.2.2 Any and all tools, materials and equipment with a single-purchase fair market value of greater than $50 that are bought or created for the Project shall be the property of the Owner. The Design/Builder shall prepare and keep current a log of such items. Upon completion of the Work or when requested by the Owner, the Design/Builder shall give a proposal to the Owner to pay the Owner a sum equal to the depreciated value of the tools, materials and equipment the Design/Builder wishes to retain, which the Owner may accept, negotiate or reject as the Owner sees fit. If the Owner does not accept the proposal, the Design/Builder shall deliver all such tools, materials and equipment to the Owner in a manner directed by the Owner.

Commented [AR16]: Fixed fee with 50% at risk, to 50% design. Then signature of execution contract for the remainders. Lump sum with potentially performance adjustment for budgets, timeline, performance, subsidies… Or just plain lump sum.

Commented [ML17]: See Project Agreement Section for an alternative proposal.

Commented [AR18]: Section 6.1.2 Why so much control on inputs vs output? We suggest more overall project control on execution, and less on cost aspect since it is a lump sum agreement with very limited options for change orders. Fixed process = variable outcomes or fixed outcomes = variable process.

6.1.2.3 The Design/Builder shall prepare and submit to the Owner, in writing, a Control Estimate at a time mutually agreed upon by the parties, once the Drawings are sufficiently advanced to prepare the estimate. The Control Estimate shall include the estimated Construction Costs plus the Design/Builder's Fee. The Control Estimate shall be used to monitor actual costs and the timely performance of the Work. The Design/Builder shall update the Control Estimate with each Application for Payment as needed to reflect Changes in the Work.

.1) To the extent that the Drawings and Specifications are anticipated to require further development, the Design/Builder shall provide in the Control Estimate for such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated in a revised Control Estimate by mutual agreement of the parties.

.2) The Design/Builder shall develop and implement a detailed system of cost control that will provide the Owner with timely information as to the anticipated total Construction Cost. The cost control system shall compare the Control Estimate with the actual cost for the activities in progress and estimates for uncompleted tasks and proposed changes. This information shall be reported to the Owner, in writing, no later than the Design/Builder's first Application for Payment and shall be revised and submitted with each Application for Payment.

6.1.2.4 The Contingency shall be a sum established by the Design/Builder and accepted by the Owner that may be drawn upon, only to extent of its funding at the time of such need, to pay for the following only:

.1 Construction Costs arising from further development of the Program following the submission of the Construction Proposal.

.2 Construction Costs arising during construction that could not have been fully identified or defined by the Design/Builder at the time of the establishment of the Control Estimate; and

.3 The Design/Builder's Construction Fee applicable to the costs set forth in § 6.1.2.4.1 and § 6.1.2.4.2.

6.1.2.5 The Contingency shall not be used for costs covered by a Change Order, or caused by the breach of contract, negligence, or intentional act or omission of the Design/Builder or its Consultant or Subcontractor of any tier.

6.1.2.6 No expenditures from the Contingency shall be made without prior written authorization by the Owner for (a) any change in excess of Five Thousand Dollars ($5,000) to any Subcontract or (b) any use for payment of labor

Commented [ML19]: The Costs estimate will be developed in collaboration with Yale to show transparency. The approach we have proposed minimize the cost risk for Yale and is based on an integrated construction process.

employed or hired directly by the Design/Builder. For Subcontract changes less than Five Thousand Dollars ($5,000), the Owner's approval is not required.

6.1.2.7 After the Owner's acceptance of a Construction Proposal, the Fee shall be applied to each net increase or decrease of the Construction Cost by Change Order. The Fee shall be adjusted only as described in Article 7.

6.1.2.8 If the Owner elects to reduce the Scope of Work, the Owner shall pay the Design/Builder for all Work performed and Fee incurred through the date that the Owner notifies the Design/Builder of the reduction in scope, along with other scope reduction related costs that cannot otherwise be mitigated. Under no circumstances will Design/Builder be entitled to payment or damages on Work not performed, including without limitation anticipated Fee or profit.

6.1.5 **Performance Monitoring Phase.** The Design/Builder's compensation for Work performed to monitor performance of energy measures shall be set forth in Exhibit C and as follows.

.1 Performance Monitoring Phase. Fee shall be based on a percentage of the estimated DAPC that is mutually agreed upon between the Owner and DesignBuilder. Upon Owner's acceptance of a Construction Proposal for Owner-selected scopes of work, the Design/Builder's Fee for such Performance Monitoring Services shall be adjusted to reflect the percentage based on the actual Construction Cost set forth in the Construction Proposal for the selected scope of work.

Commented [AR20]: Included in lump sum approach.

6.2 **Applications for Payment.** The Design/Builder shall submit monthly applications for payment in the form of AIA Document G702 Application and Certificate for Payment with a continuation sheet in a form approved by the Owner and shall include only those changes memorialized in a Change Order. Prior to the commencement of construction, the Design/Builder shall submit for the Owner's approval a separate schedule of values allocating the Construction Phase portion of the Contract Sum among the various portions of the Work, reserving separate line items for individual subcontracts and any Contingency. During construction, individual line items in the schedule of values shall not be changed or revised without the Owner's written consent and the Design/Builder's applications for payment shall be based on the approved schedule of values.

Commented [AR21]: We suggest monthly progress payment based on final design and pricing, submitted for approval. Again, less granularity but more information about project performance with KPIs on collaboration, rework, performance etc

6.2.1 The Design/Builder shall submit Applications for Payment in accordance with the Owner's instructions provided at https://facilities.yale.edu/invoices. Applications for Payment must be legible, clearly organized, specifically correlated with the required back-up information, and accompanied by:

.1 For included Personnel Costs, an itemized statement of the actual hours devoted to the Project by the Designated Personnel during the billing period;

.2 Invoices from Consultants and Subcontractors of all tiers;

.3 A certification that the Design/Builder has satisfied all of its financial obligations on account of labor, services, materials or equipment furnished to the Project by its Consultants and Subcontractors and included in previous applications paid by the Owner;

.4 Partial releases and lien waivers, in a form provided by the Owner (attached as an Exhibit hereto), from the Design/Builder and its Consultants and Subcontractors for labor, services, materials or equipment furnished to the Project through the date covered by the last preceding application for payment, except for any permitted retainage;

.5 The Schedule;

.6 Written warranties from Subcontractors, manufacturers and installers covering portions of the Work that have reached Substantial Completion;

.7 A Contingency tracking log, for GMP's; and

.8 Such other data, accounts and receipts substantiating costs incurred by the Design/Builder as reasonably requested by the Owner.

6.2.2 The Design/Builder shall prepare and submit by the 25th day of each month a pencil copy of each application for payment for the Owner's review. By the first day of the following month, the Design/Builder shall submit its application for payment, certified by the Design/Builder and its design professional, incorporating all of the Owner's comments and accompanied by supporting documentation required by the Contract Documents. Payments shall be made within thirty (30) Days after receipt by the Owner. The Design/Builder shall promptly, but in no event later than ten (10) Days after payment by the Owner, pay its Consultants and Subcontractors the amounts to which they are entitled.

.1 The Design/Builder's signature on an application for payment constitutes its certification that: (a) the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents; (b) the amounts sought are due and earned in accordance with the Contract Documents; (c) the Work is progressing in accordance with the Schedule and the Substantial Completion date established therein; (d) it shall use the amounts certified to discharge their financial obligations on account of labor, services, materials or equipment furnished to the Project and included in the application for payment; (e) it has discharged its financial obligations on account of labor, services, materials or equipment furnished to the Project for which the Owner has made payment; (f) to the best of its knowledge, there are no claims of liens, security interests or encumbrances in favor of persons or entities that provided services, labor, materials and/or equipment to the Project on their behalf; and (g) title to all Work covered by the application has passed to the Owner no later than the time of payment.

6.3 Retainage. The Design/Builder's applications for payment shall be subject to retainage of 5.0%. The retainage may be reduced at the Owner's sole option to less than 5.0% at the time of Substantial Completion. Otherwise, the retainage shall be held until Final Completion, acceptance of the Work by the Owner, and the completion of the Owner's audit. Interest shall not accrue or be payable on retainage.

6.4 Withholding. The Owner may, in its sole discretion, withhold payment from the Design/Builder to the extent necessary to protect the Owner from: (a) loss due to Defective Work, whenever discovered, or to reimburse the Owner for losses for which it is entitled to indemnity from the Design/Builder under the Contract Documents; (b) failure to progress the Work in accordance with the Schedule or failure to submit Schedules in accordance with the Contract Documents; (c) uninsured loss due to personal injury or damage to the Work or the work of Separate Contractors to the extent of the responsibility of the Design/Builder; (d) Claims of nonpayment by persons or entities that furnished labor, services, materials or equipment to the Project for or on behalf of the Design/Builder; or (e) persistent failure of the Design/Builder to perform the Work in accordance with the Contract Documents.

6.4.1 The Owner may apply any amounts withheld as it deems proper to satisfy or set off against Claims, secure its protection, complete the Work or compensate itself for losses suffered by reason of the Design/Builder's nonperformance or default.

6.5 Trust Funds. Any funds that the Design/Builder receives in payment for services or Work performed by its Subcontractors or Consultants under this Agreement shall constitute assets of a trust, which trust funds shall be used for the exclusive benefit of the Design/Builder's Subcontractors and Consultants for the purpose of discharging the Design/Builder's financial obligations on account of labor, services, materials or equipment furnished to the Project by the Design/Builder's Consultants and Subcontractors, provided that such labor, services, materials or equipment were due and earned in accordance with the Contract Documents, were included in a payment application to the Owner, and were paid by the Owner to the Design/Builder. The Design/Builder shall be the trustee of the trust and shall be required to deal with the trust assets for the benefit of its Subcontractors and Consultants. The Design/Builder shall not be a beneficiary of the trust. Nothing herein shall be construed as an intent to require that the Design/Builder maintain trust funds in separate bank accounts, designate any third party as a beneficiary of the trust created herein, or otherwise give rise to any cause of action against the Owner by any third-party beneficiary of the trust created herein.

6.6 Joint Checks. In the Owner's sole discretion, whether or not upon default by the Design/Builder, the Owner may, following discussion with the Design/Builder, make payment by joint check to a Subcontractor or Consultant of any tier, and such payments shall be deemed to have been made on account of the payee and all tiers between the payee and the Owner. Any payment made by the Owner by joint check shall not be construed as a promise to assume the debt of any joint payee, nor as a continuing obligation to make joint payments, nor as an assumption or establishment of a direct contractual relationship with the payee unless expressly stated in a separate written agreement with such Subcontractor or Consultant.

6.7 Unit Prices and Allowances. An Allowance is an amount included in the Contract Sum as an estimate to cover portions of the Work reasonably inferable from the Contract Documents, but whose quality, quantity or configuration is subject to modifying circumstances. Unless otherwise approved by the Owner, an Allowance includes Subcontractors' cost of labor, materials and equipment, less applicable trade discounts, plus costs for unloading and handling at the Project Site, installation costs, overhead, profit and all other amounts contemplated for the portion of the Work covered by the Allowance. Promptly after the quantities of unit price items and the costs of Allowances in the Contract Sum become quantifiable and can be fixed, the Design/Builder shall submit to the Owner adequate documentation of

such actual quantities and/or costs, and the Contract Sum shall be adjusted by Change Order. The Design/Builder shall not proceed with Work covered by an Allowance without proper written authorization from the Owner pursuant to Article 7.

ARTICLE 7. CHANGES

7.1 Owner Changes. The Owner may, without invalidating this Agreement, add, delete, modify or alter the Design/Builder's services within the general scope of this Agreement for each Project, and add, delete, modify or alter the Work within the general scope of the Contract Documents. If the Design/Builder receives any instructions that is inconsistent with, or outside the scope of, this Agreement, or is requested by the Owner to provide pricing for a requested change or encounters unanticipated conditions, any of which will result in a change in the Contract Time or the Contract Sum, it shall, within ten (10) Days and before commencing or performing such services or work, notify the Owner and provide a written summary of the impact of the change on the Project, the Contract Sum and the Schedule. Except for emergencies, the Design/Builder shall not undertake any addition, deletion, modification or alteration in the Work without an executed Change Order, Construction Change Directive or written directive for a minor change as provided in this Article 7.

7.2 Change Orders. A Change Order is a writing signed by the Owner and Design/Builder setting forth their agreement as to a change in the Work, Contract Sum and/or the Contract Time, and constitutes a final settlement of all matters relating to the change that is the subject of the Change Order. Change Orders shall be prepared on the Owner's Change Order form.

7.3 Change Directives. The Owner may direct a change in the Work within the general scope hereof without agreement on the impact of the change, if any, on the Contract Sum or Contract Time, by issuing a Change Directive in writing and signed by the Owner. Upon receipt of a Change Directive, the Design/Builder shall proceed with such services expeditiously and promptly provide the Owner with its proposed change to the Contract Sum, Schedule and Contract Time on account of the Change Directive.

7.4 Change Pricing. All proposed changes and Claims by Subcontractors shall be evaluated and approved by the Design/Builder prior to submission to the Owner and shall be subject to the Owner's audit in accordance with § 4.4. The maximum mark-up for overhead and profit of the Design/Builder or a Subcontractor of any tier performing changed work solely with its own forces under a lump sum agreement shall be 15%. Whether the Work is performed on the basis of a GMP or lump sum, the maximum cumulative mark-up to the Owner for overhead and profit of the Design/Builder and Subcontractors of all tiers for changed work shall be 20%. However, when performing the Work on the basis of a GMP, the Design/Builder's Construction Fee shall be included in the above cumulative markup.

7.5 *Force Majeure*. An entity's non-performance caused by unforeseeable conditions beyond its control and without its fault or negligence by reason of fire, severe flooding from water courses, unavoidable property casualty, riots, labor disputes not covered by applicable project labor agreements, delays by Governmental Authorities, unusually severe meteorological or seismic activity, the loss of power, communications or utilities to the Project, epidemics, pandemics, quarantines, acts of war, acts or threats of terrorism or governmentally declared emergencies shall not result in a default by the Design/Builder during the period such forces are in effect at the Project Site and are having a specific

impact on its performance on the Project. Upon the occurrence of such a *force majeure* event, the entity whose performance is excused by this section shall be entitled to a Change Order adjusting the Contract Time and/or Contract Sum, provided that the Design/Builder has complied with the Contract Documents and submitted a change request that documents fully the amount of damages directly caused by the *force majeure* event, and further provided that it used its best efforts to mitigate all delay, damages and losses that accrue from such event. The Design/Builder acknowledges and agrees that except as expressly set forth herein, shortage of funds or inadequate capitalization on its own behalf, labor disputes covered by applicable project labor agreements, and industry-wide economic fluctuations impacting price, availability or delivery time or conditions shall not excuse its non-performance as a *force majeure* or otherwise, and the Design/Builder shall bear all risk of monetary loss and delay. The Design/Builder expressly agrees not to invoke this section based on labor unrest arising from the Owner's labor units.

7.6 Continuing Performance. Pending final resolution of a Change Order, Change Directive or Claim, the Design/Builder shall proceed diligently with performance of its contractual obligations and all changes directed by the Owner.

7.7 Minor Changes. The Design/Builder may, by written directive, order minor, technical changes in the Work not involving an adjustment of the Project Time, the Construction Cost, the GMP or matters relating to aesthetic effect, and not inconsistent with the intent expressed in the Contract Documents.

ARTICLE 8. INSURANCE AND INDEMNITY

8.1 Design/Builder's Insurance. During the term of the Agreement and for any such time as may be required herein, the Design/Builder and its Subcontractors and Consultants shall provide for and maintain insurance in compliance herewith covering the activities of Design/Builder and Subcontractors and anyone for whose acts the Design/Builder may be liable.

8.1.1 Commercial General Liability. The Design/Builder shall maintain commercial general liability insurance covering all operations by or on behalf of the Design/Builder on an occurrence basis with the limits coverage as follows:

.1	$2,000,000	Annual General Aggregate
.2	$2,000,000	BI/PD Each Occurrence
.3	$2,000,000	Products and Completed Operations Aggregate
.4	$1,000,000	Personal & Advertising Injury
.5	$100,000	Fire Damage (Any One Fire)
.6	$10,000	Medical Expense (Any One Person)

8.1.2 Automobile Liability. The Design/Builder shall maintain commercial automobile liability insurance covering liability arising out of any auto (including owned, hired and non-owned autos). Such insurance shall provide limits and coverage as follows:

.1	$1,000,000	Combined single limit each accident

8.1.3 Workers' Compensation. The Design/Builder shall maintain, in the state of Connecticut and elsewhere as may be required by Applicable Law, workers' compensation and employers' liability coverage with the following limits and coverage: **.1** Workers

compensation coverage: statutory requirements **.2** Employer's liability coverage with limits not less than:

(a) $1,000,000 Bodily injury for each accident
(b) $1,000,000 Bodily injury by disease for each employee
(c) $1,000,000 Bodily injury disease aggregate

.3 Including Waiver of Right to Recover from Others Endorsement (WC 00 03 13) where permitted by Applicable Law, naming Owner.

8.1.4 Aircraft/Watercraft Liability. The Design/Builder or aircraft/watercraft operator will maintain coverage for loss arising from operations of any owned, hired and non-owned aircraft, including UAVs or watercraft, maned or unmanned, used in the performance of the Work. Such insurance shall provide limits and coverage as follows:

.1 Limits:

$50,000,000 each occurrence (excluding UAVs)
$50,000,000 each person (excluding UAVs) $ 2,000,000
each occurrence for use of UAVs

.2 Coverages:

(a) Waiver of subrogation.
(b) Contractual liability coverage (including liability for employee injury assumed under a contract)

8.1.5 Pollution/Environmental Impairment Liability Insurance. In the event that any disruption, handling, abatement, remediation, encapsulation, removal, transport, or disposal of Hazardous Materials is required, the Design/Builder shall secure, or cause to be secured, pollution liability insurance, in addition to the other coverages contained herein.

.1 Limits:

(a) $5,000,000 Each Occurrence
(b) $5,000,000 Aggregate **.2** Coverages:

(a) Bodily injury, sickness, disease, mental anguish, shock, and death.
(b) Property damage, including physical injury to or destruction of tangible property including the resulting loss of use thereof, clean-up costs, and the loss of use of tangible property that has not been physically injured or destroyed.
(c) Blanket waiver of subrogation rights against the Owner, and its officers, employees and agents.
(d) Contractual Liability (including liability for employee injury assumed under a contract).
(e) Additional Insured Endorsement.

8.1.6 Umbrella/Excess Liability. The Design/Builder shall maintain umbrella/excess liability insurance on an occurrence basis in excess of the underlying insurance described herein as follows, which shall be at least as broad as each and every coverage area of the underlying policies. The amounts of insurance required herein may be satisfied by combination of underlying and umbrella limits, so long as the total amount of insurance is not less than the limits specified in this Paragraph.

.1 $10,000,000 Each occurrence combined single limit
.2 $10,000,000 Aggregate limit

8.1.7 Professional Liability Insurance. The Design/Builder shall maintain professional liability insurance on a claims-made basis with the following limits:
.1 $2,000,000 Per claim **.2**
$2,000,000 Aggregate

8.2 General Insurance Provisions.

8.2.1 Certificates of Insurance. For all required insurance coverages, prior to commencing any Work or services hereunder, the Design/Builder shall provide to the Owner a certificate of insurance completed by a duly authorized representative of its insurer certifying that at least the minimum insurance coverages required herein are in effect, naming the Owner and others as additional insureds as set forth herein and specifying that the coverages will not be canceled, non-renewed, or materially changed by endorsement or through issuance of other policy(ies) of insurance without thirty (30) Days advance written notice and specifying a ten (10) Day written notice for non-payment of premium, to:

contract.administration@yale.edu

and

Contract Administration

Yale University, Office of Facilities

P.O. Box 208297

New Haven, CT 06520-8297

The Owner's acceptance of a certificate of insurance does not constitute approval of coverage that is not in compliance with this Agreement.

8.2.2 Insurer Qualification. All required insurance shall be provided through companies authorized to do business in the State of Connecticut with a Best rating of A- or better unless otherwise specifically approved by the Owner. A copy of all insurance policies required herein shall be made available for the Owner's review at a mutually convenient time and place within ten (10) Days of the Owner's written request.

8.2.3 Insurance Primary. All insurance coverages provided by the Design/Builder and those for whom it is liable shall be primary, and any insurance or self-insurance program carried by the Owner will be considered excess.

8.2.4 No Reduction or Limit of Obligation. By requiring insurance herein, the Owner does not represent that coverage and limits will necessarily be adequate to protect the Design/Builder. The insurance required herein does not reduce or limit Design/Builder's contractual obligations in connection with its performance on the Project.

8.2.5 **Additional Insureds.** The Design/Builder and those for whom they are responsible shall, to the fullest extent permitted by Applicable Law, add and include the Owner, its trustees, directors, officers, representatives, agents and employees as additional insureds on all liability policies required hereunder, with the exception of workers compensation and professional liability coverage. The additional insured status must apply to ongoing operations as well as products/completed operations and at the same limits required herein for commercial general liability coverage. Additional insured coverage provided under general liability and umbrella/excess liability policies must be provided under ISO forms CG 20 10 10 01 and CG 20 37 10 01 or their equivalent, if approved in writing by Owner. Additional insured coverage on liability policies will be primary coverage to any other coverage maintained by such additional insureds and shall not permit or require such other coverage to contribute to the payment of any loss. The Design/Builder and Subcontractors agree, for the purpose of additional insured coverage only, that the Work is being performed pursuant to a direct contractual obligation with such additional insureds and that the obligations hereunder to provide additional insured coverage are specifically enforceable by such additional insureds.

8.2.6 **Duration of Coverage.** All insurance coverages provided by the Design/Builder shall be maintained without interruption during the entire term of this Agreement and for such additional time as required herein for specific types of insurance.

8.2.7 **Continuous Operations.** The Owner and occupants of campus buildings will continue their activities and operations at or adjacent to the Project Site during the performance of the Work. Any general liability policies provided by Design/Builder shall not contain any endorsements that exclude property of the Owner that is not deemed to be in the care, custody, or control of the Design/Builder or those for whom it is liable.

8.2.8 **Retroactive Date and Extended Reporting Period.** If coverage is written on an occurrence basis, coverage must be maintained for a period of at least five (5) years after Substantial Completion. If coverage is written on a claims-made basis, the Design/Builder represents that any retroactive date applicable to the coverage precedes the effective date of its Agreement (including all services and work for the Project), and agrees that continuous coverage will be maintained for a period of at least seven (7) years after final payment to provide five (5) years of completed operations coverage and an additional two (2) years to report claims that are made.

8.2.9 **Subrogation Waiver.** The Owner and the Design/Builder hereby waive all rights of recovery, and will cause and require their respective Subcontractors, Separate Contractors and Consultants of all tiers to waive all rights of recovery, and will cause and require each of their respective insurers and the insurers of each of their respective Subcontractors, Separate Contractors and Consultants to waive all rights of subrogation, against each other, their agents, officers, directors, employees and those for whom they are liable, excluding any applicable deductible.

8.2.10 **Subcontractors' Insurance.** The Design/Builder shall cause all Subcontractors Consultants of all tiers, and those for whom they are responsible to provide and maintain insurance in

compliance herewith, using good business judgment in establishing coverage limits and deductible applicable to such insurance, and subject to the Owner's approval. The Design/Builder shall furnish to the Owner copies of certificates of insurance evidencing coverage for each Subcontractor and Sub-subcontractor.

8.2.11 **Adjustment of Losses.** Any property loss under the policies required hereunder shall be evaluated and adjusted by the Owner's insurance adjuster and made payable to the Owner as trustee for the insureds as their interests may appear, subject to the requirements of any applicable mortgagee clause.

8.2.12 **Joint Ventures.** If the Design/Builder is a joint venture involving two or more entities, then either each independent entity shall satisfy the limits and coverages specified in this Article or the joint venture shall be a named insured under each policy with one entity's policy clearly indicating that it is primary.

8.2.13 **Excluded Obligations.** The Owner shall bear no responsibility and shall provide no coverages for any obligations of the Design/Builder, or those for whom it is liable, under any contract, including without limitation rental agreements for equipment used at the Project Site.

8.2.14 **ISO Forms.** To the extent applicable, the types of insurance shall conform to the minimum terms, conditions, and coverages of the Insurance Service Office (ISO) policies, forms, and endorsements.

8.2.15 **Deductibles.** In the event that the Design/Builder maintains required insurance coverage subject to a self-insured retention or deductible, the Design/Builder must identify on the certificate of insurance the nature and amount of such self-insured retention or deductible. No self-insured retention or deductibles shall be in excess of $50,000, unless otherwise approved in advance in writing by the Owner. The Owner shall not be responsible to reimburse the Design/Builder for any amounts paid by the Design/Builder on account of its deductible or self-insured retention.

8.3 Indemnification. To the fullest extent permitted by law, the Design/Builder shall indemnify, defend (except as noted below) and hold harmless the Owner, its officers, trustees, directors and employees ("Indemnified Parties") from and against all claims, losses, liabilities, obligations, costs, fines, penalties, expenses and damages (including reasonable fees and charges of engineers, architects, attorneys and other professionals and court and dispute resolution costs) arising out of or resulting from the performance of or lack of performance of the Work, to the extent caused by any violations of Applicable Law, breach of contract, negligent act or omission, or intentional misconduct by them or anyone for whose acts or omissions they may be liable, unless and to the extent caused in part by the Indemnified Parties. The Design/Builder's duty to defend the Indemnified Parties shall not extend to claims covered solely by the Design/Builder's professional liability policy required hereunder.

8.3.1 As to any and all claims against the Indemnified Parties by any employee of the Design/Builder or anyone for whose acts the Design/Builder may be liable, the indemnification obligation under this paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the

Design/Builder under worker's compensation acts, disability benefit acts or other employee benefit acts.

8.3.2 The Design/Builder agrees and does hereby assume, on behalf of the Owner, the defense of any action that may be brought against the Indemnified Parties for which the Owner is entitled to a defense and to pay on its behalf, upon demand, any judgment or award entered in any such action.

8.3.3 The Owner reserves the right to retain its own counsel and to charge any reasonable counsel fees to the Design/Builder. The Design/Builder expressly consents to the Owner's selection of legal counsel and waives any waivable conflict.

8.4 Owner's Property Insurance. The Owner shall purchase and maintain property insurance covering its property and the Work on the Project Site in the amount of the completed value upon a replacement cost basis. The property insurance is on an all-risk policy form and includes builder's risk and boiler and machinery coverages. In the event that the Design/Builder or those for whom it is liable, is responsible for such loss, the other provisions of this Agreement shall apply, as to amounts not recovered through the Owner's property insurance.

8.4.1 The Owner's property insurance does not protect the Design/Builder against loss of items owned or leased, such as sheds, tools, scaffolds, other construction equipment, and the like, nor will it cover portions of the Work stored off site or in transit.

8.4.2 The Design/Builder shall provide insurance coverage for items owned or leased and for portions of the Work stored off site or in transit.

8.4.3 A loss insured under Owner's property insurance shall be adjusted by the Owner or its representatives and made payable to the Owner, or otherwise at the direction of the Owner, subject to requirements of any applicable mortgagee clause. The Design/Builder shall pay Subcontractors and Consultants their shares of insurance proceeds received by the Design/Builder, and by appropriate agreements, written where legally required for validity, shall require them to make payments to their subcontractors and consultants in a similar manner.

8.5 Bonding. For all subcontracts in excess of $250,000, the Design/Builder shall ensure that the Subcontractors furnish payment and performance bonds in the penal sum equal to one hundred percent (100%) of the subcontract and in a form provided by the Owner. The Owner shall be named as a dual obligee on all bonds posted by Subcontractors. The required bonds shall be provided by a surety company or companies acceptable to the Owner, authorized to transact business within the State of Connecticut, and named in the current listing by the Department of the Treasury of approved sureties (Department Circular 570). Within ten (10) Days of the Design/Builder's award of a subcontract for which bonding is required and prior to such Subcontractor's commencement of work, the Design/Builder shall deliver to the Owner the original bonds obtained from the Subcontractor.

8.5.1 The Design/Builder may submit a proposal to furnish a design/build bond in lieu of the bonding requirements herein, which the Owner may accept, negotiate or reject as the Owner sees fit.

ARTICLE 9. TERMINATION OR SUSPENSION

9.1 Suspension. The Owner may suspend the Work in whole or in part for its convenience and without cause, for such period as the Owner may require, upon not less than seven (7) Days' written notice to the Design/Builder specifying the extent of the suspension, the effective date, and, if known, the duration of the suspension. In the event that the Owner suspends the Work, the Design/Builder shall be compensated for Work performed prior to the effective date of suspension, and at the end of the suspension an adjustment to the Contract Sum and/or Contract Time on account of such suspension or interruption may be made at the discretion of the Owner, provided that no adjustment shall be made to the extent that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Design/Builder is responsible.

9.2 Termination for Convenience. The Owner may terminate this Agreement in whole or in part for its convenience and without cause upon not less than seven (7) Days' written notice to the Design/Builder specifying the extent of termination and the effective date.

9.2.1 In the event of a termination for the Owner's convenience, the Design/Builder shall receive, as its sole remedy, compensation for the portion of the Contract Sum earned prior to the effective date of termination, together with the Design/Builder's reasonable de-mobilization expenses. Under no circumstances shall the Design/Builder be entitled to additional payment or damages, including, without limitation, anticipated fees or profit, which are hereby expressly waived.

9.3 Termination for Cause. This Agreement may be terminated in whole or in part by the Owner upon seven (7) Days' written notice, and by the Design/Builder upon thirty (30) Days' written notice in the event of substantial failure to perform in accordance with the terms of this Agreement by the other party through no fault of the terminating party and provided such breach is not corrected within said notice period. In the event that a termination by the Owner for cause is ultimately deemed wrongful by a trier of fact, such termination shall be conclusively deemed to be a termination for convenience by Owner.

9.3.1 Sufficient cause for the Owner to terminate hereunder for cause shall exist if the Design/Builder: (a) abandons its contractual obligations; (b) substantially fails to perform in accordance with the terms of this Agreement; (c) fails to perform its contractual obligations with the diligence that will ensure its completion within the time specified in the Schedule, including any authorized extension; (d) fails to supply enough properly skilled personnel or proper materials in the performance of its contractual obligations; (e) fails to make payment to Subcontractors or Consultants for services, labor, materials or equipment furnished in accordance with their respective subcontract or consulting agreements; (f) fails to remove a mechanic's lien recorded against the Project or Owner's property by a party claiming entitlement through it, for which payment has been made by Owner; (g) fails to provide satisfactory assurances to the Owner of its ability to properly complete its contractual obligations; (h) repeatedly disregards Applicable Laws; (i) submits an invoice, application for payment, sworn statement, lien waiver, certification, affidavit or document of any nature whatsoever that is intentionally falsified; (j) voluntarily files for bankruptcy protection or becomes subject to any reorganization, receivership, involuntary proceeding or similar

proceeding, or any involuntary action in bankruptcy or a similar proceeding is commenced against it; (k) has a receiver, liquidator, trustee or assignee appointed for all or a substantial portion of its property; or (l) admits in writing that it is unable to pay its debts generally as they become due or makes a general assignment for the benefit of its creditors.

9.3.2 In the event of a termination of the Design/Builder for cause, then payment shall be withheld until the Work is completed and the Owner's damages and/or costs of completion are liquidated and no longer contingent. If the unpaid balance of the Contract Sum exceeds

the Owner's damages and costs, such excess shall be paid to the Design/Builder. If the Owner's damages and costs exceed the unpaid balance of the Contract Sum, the Design/Builder shall pay the difference to the Owner.

9.4 Duties Upon Termination. Upon receipt of a written notice of termination for convenience or for cause, the Design/Builder shall immediately, in accordance with instructions from the Owner, proceed with the performance of the following duties regardless of any delay in determining or adjusting amounts that may be due on account of the termination:

9.4.1 Cease operations as specified in the notice;

9.4.2 Place no further orders and enter into no further agreements for services, labor, materials or equipment except as necessary to complete portions of the Work or services not terminated;

9.4.3 Except to the extent they relate to Work or services to be performed prior to the effective date of termination, terminate all orders and agreements to the extent they relate to the portions of the Work or services terminated;

9.4.4 Proceed as necessary to complete the portions of the Work or services not terminated;

9.4.5 Arrange for the transition of subcontracts and consulting agreements to the Owner or such third party as the Owner may direct in accordance herewith;

9.4.6 Provide the Owner with a written status of its performance of the portions of the Work or services terminated, including an inventory of materials and equipment stored at the Project Site, those stored off-site that have been included in an application for payment, and those being specially fabricated off-site; and

9.4.7 Take all action that may be reasonably necessary, or that the Owner may direct, for the protection and preservation of the portions of the Work or services terminated.

9.5 Work Completed. In the event of a termination or suspension pursuant to this Article, the Design/Builder shall not be relieved of any responsibilities for the completed portions of the Work, nor shall such termination or suspension relieve any sureties of their obligations to ensure completion of the Work and to pay legitimate Claims arising out of the Work.

ARTICLE 10. DISPUTE RESOLUTION

10.1 Claims. A Claim is a demand or assertion seeking adjustment in compensation, payment of money, extension of time or other relief with respect to, arising out of or relating to the terms of this

Agreement. Unless otherwise specifically required by the Contract Documents, Claims by the Design/Builder must be made by written notice within thirty (30) Days after the claimant has knowledge, or reasonably should have knowledge, of the circumstances giving rise to such Claim, regardless of whether the full effect of the circumstances giving rise to the Claim are then known. It is understood that the failure to provide written notice within this time period will greatly prejudice the Owner, and the failure to submit proper and timely notice shall constitute a waiver and abandonment of the Claim.

10.1.1 The issuance by the Owner of a Construction Change Directive or a denial by the Owner of a requested change in the Work or services shall constitute an event giving rise to a Claim.

10.2 Claim Review. The parties' claim representatives shall meet in good faith within fifteen (15) Days of the submission of a Claim to endeavor to resolve the Claim on their own. If the parties are unable to resolve the Claim in this manner, the Claim shall be mediated as set forth below.

10.3 Mediation. As a condition precedent to litigation or arbitration, the parties shall endeavor to settle disputes by non-binding mediation with a mutually acceptable dispute resolution administrator. A demand for mediation shall be made within a reasonable time after the Claim, dispute or other matter in question has arisen. Any such mediation shall be administered and conducted in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect, unless the parties mutually agree otherwise. The demand for mediation shall be made in no event later than the date when institution of legal or equitable proceedings based on such Claim, dispute or other matter in question would be barred by the applicable statute of limitations.

10.4 Arbitration. The Owner may, at its sole discretion and option, choose to have any or all Claims, disputes or other matters in question between the parties to this Agreement decided by arbitration administered by a mutually acceptable dispute resolution administrator and in accordance with the Owner's Limitations on Submissions, attached and incorporated herein as Attachment No. 1. The Construction Industry Arbitration Rules of the American Arbitration Association shall govern where not in conflict with the Owner's Limitations on Submissions. Any such arbitration may include, at the Owner's sole discretion, by consolidation, joinder and in any other manner, third-parties whose interests relate to the matters in arbitration.

10.4.1 If the Owner consents to arbitration, the demand for arbitration shall be made promptly after the occurrence of the event giving rise to the Claim, and in no event later than the date when institution of legal or equitable proceedings based on such Claim, dispute or other matter in question would be barred by the applicable statute of limitation. The venue for arbitration shall be at a locale in the Greater New Haven, Connecticut area acceptable to the Owner.

10.4.2 If the Owner consents to arbitration, the award rendered by the arbitrator(s) shall be final, and subject to appeal only as provided in the Owner's Limitations on Submissions, and judgment may be entered upon in accordance with the laws of the State of Connecticut.

10.4.3 If the Owner does not consent to arbitration, all disputes shall be subject to determination by a court of competent jurisdiction, and the venue for such action shall be New Haven, Connecticut. The parties hereby waive any and all rights to a jury trial with respect to disputes arising out of the Agreement and agree that any claim for a jury trial shall be

stricken by consent if either party violates this provision. The parties agree that this is a commercially reasonable term and that it shall be specifically enforced.

10.4.4 The Design/Builder shall incorporate the dispute resolution provisions of this Article in substantially the same form in its agreements with Subcontractors and Consultants.

ARTICLE 11. MISCELLANEOUS

11.1 Copyrights, Patents and Royalties.

11.1.1 The Owner shall be deemed the owner of all designs, architectural works and Instruments of Service prepared or created by or on behalf of the Design/Builder (including common law, statutory and other reserved rights, in such designs, architectural works and Instruments of Service), limited to the extent that they pertain to unique elements of the Project that are: (a) developed exclusively for this Project; (b) based on unique Specifications, designs or other data provided by the Owner; or (c) developed independently by the Owner ("Limited Copyright"). All designs, architectural works and Instruments of Service covered by the Limited Copyright shall be deemed works for hire and, except as expressly set forth herein, the Design/Builder hereby assigns any and all rights in and to them to the Owner.

.1 The Design/Builder grants to the Owner a nonexclusive, indefinite and irrevocable license to use and reproduce all elements of the design, architectural works and Instruments of Service prepared or created hereunder and not covered by the Limited Copyright for purposes of constructing, using and maintaining the Project. The Design/Builder shall obtain similar licenses and assignments for the Limited Copyright from its Consultants and Subcontractors.

.2 Except for the licenses granted herein, no other license or right shall be deemed granted or implied. The Design/Builder shall not assign, delegate, sublicense, pledge or otherwise transfer any license to the Limited Copyright granted herein to another party without the prior written agreement of the Owner.

.3 The Design/Builder and its Consultants and Subcontractors of all tiers may reproduce applicable portions of the Instruments of Service appropriate to and for use in their execution of the Work.

.4 The Design/Builder and its Consultants and Subcontractors of all tiers may each use and reproduce the Instruments of Service that such party has created in the future for purposes not inconsistent with the Limited Copyright.

.5 Submission or distribution of Instruments of Service to meet official regulatory requirements or for similar purposes in connection with the Project is not to be construed as publication in derogation of the reserved rights set forth herein.

.6 The Owner may use the Instruments of Service for the completion of the Project or for reference with respect to any future alteration or expansion, all without permission from or further compensation to the Design/Builder, provided that all identification of the Design/Builder shall be removed from the Instruments of Service subsequent to modification by or on behalf of the Owner.

.7 The Owner shall indemnify and hold the Design/Builder harmless from and against liability, damage or loss arising from, and only to the extent of, any changes made to the Instruments of Service by the Owner for completion of the Project or with respect to any construction other than the Project (including any future additions to the Project).

11.1.2 Royalties and Licenses. The Design/Builder shall not use a design, process or product for which they have not obtained all necessary permissions and paid all royalties and license fees.

11.2 Notices. Written notices pursuant to this Agreement shall be delivered: (a) by hand, (b) by U.S. Mail, (c) by tracked, overnight delivery, or (d) by courier, and shall be addressed to the Designated Representatives of the Owner and Design/Builder at the above addresses. Transmissions by fax or e-mail shall not constitute written notice. Written notices delivered by hand to attendees of Project meetings shall be considered effective as to entities represented by such attendees.

11.3 Confidentiality. All information communicated or disclosed by the Owner in connection with each Project shall be deemed confidential and shall not be communicated or disclosed to any third party without the Owner's prior written authorization. Excluded from this confidentiality provision is information required to be disclosed to fulfill the obligations of Design/Builder in the performance of the services hereunder, publicly available information which became public through no fault of Design/Builder, information obtained from third parties who, to Design/Builder's knowledge, did not obtain such information, directly or indirectly, from the Owner; or information developed independently by Design/Builder as proven by written records of Design/Builder, or disclosed as required by law or in defense of a Claim , provided that written notice of such law or Claim is given without undue delay to the Owner so as to give the Owner an opportunity to intervene prior to disclosure and provided further that Design/Builder uses reasonable efforts to obtain assurance that the applicable information will be treated confidentially. Information which is disclosed in such a manner must be marked "Confidential"

11.4 Representations of Project and Owner's Name. Following the final completion of the Project and acceptance thereof by Owner, Design/Builder may request the Owner's written permission to include images of non-confidential elements of the Project, and a brief description of the Project, that accurately depict the Work and Services provided to the Owner hereunder solely as part of Design/Builder's private portfolio. Design/Builder shall comply with the Owner's requirements and applicable guidelines, policies, rules and regulations with regard to the taking and use of images and the description of Design/Builder's work with the Project, including, without limitation, ensuring that such description is done solely in an accurate, descriptive, and factual manner. No confidential information of Owner, including, but not limited to, any information regarding cost or occupant operations related to the Project shall be permitted. Upon Owner's written approval of the selection of images and description of the work, the Design/Builder may include the approved content in portfolio presentations to individual clients.

Design/Builder may reference the Owner's name in accordance with the Owner's Guidelines for Development and/or Use of Yale Marks For Outside Consultants and Contractors, as the same may be amended from time to time and which are currently available at: https://licensing.yale.edu/use-yale-name and fully made a part hereof.

11.4.1 Except as specifically set forth above, no person or entity may use: the name, image or a reference to the Project; the Owner's name or image; the name or image of any employee, student or agent of the Owner; or any trademark, service mark, trade name, logo or symbol of the Owner or any of its schools or affiliates, in any manner, including in any sales, promotional, advertising or other publication (including client lists and websites), without the prior, written consent of the Owner in each instance, which may be withheld or conditioned in its sole discretion. It is acknowledged and agreed that immediate, extensive and irreparable damage will result if the provisions of this section are not specifically enforced. Therefore, in addition to, and not in limitation of, any other remedy available to the Owner, the Owner may enforce this section in judicial proceedings by a decree of specific performance and appropriate injunctive relief as may be applied for and granted in connection with such enforcement, and the person or entity in violation of this section after receipt of notification from the Owner will pay all of the Owner's legal fees and litigation expenses incurred in enforcing this section.

11.5 Labor Relations. In performing its services hereunder, the Design/Builder shall account for, enter into and comply with all project labor agreements and Owner policies regarding labor relations that are applicable to the Project. The Owner shall review and approve any project labor agreements for use on the Project. The Design/Builder and its Subcontractors shall make reasonable inquiry prior to employing laborers and service-providers as to whether their trade affiliations may cause strikes or work stoppages on the Project. The Design/Builder shall give to the Owner prompt notice of every labor dispute that may affect the execution or progress of the Work and shall take immediate steps to settle such disputes.

11.5.1 The Design/Builder and its Subcontractors of all tiers will not discriminate against any employee or applicant for employment because of an individual's sex, race, color, religion, age, disability, status as a special disabled veteran, veteran of the Vietnam era or other covered veteran, national or ethnic origin, sexual orientation or gender identity or expression. They will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Design/Builder agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

11.5.2 The Design/Builder and its Consultants and Subcontractors of all tiers will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor, including 41 C.F.R. § 60-1.4(b)

and the Standard Federal Equal Employment Opportunity Construction Contract Specifications at 41 C.F.R. § 60-4.3 et seq.

11.6 Minimum Wage. The Design/Builder and Subcontractors of all tiers shall pay their employees in accordance with the Owner's published minimum wage requirements, as may be amended and increased from time to time.

11.7 Independent Contractor. The relationship of the Design/Builder to the Owner will be solely that of an independent contractor and nothing contained herein will be construed as creating any other relationship.

11.8 Non-Assignability. Except as permitted herein, the Design/Builder shall not assign this Agreement or the performance of any of its obligations hereunder without the Owner's prior, written consent, which Owner may withhold in its sole discretion, and any unauthorized assignment shall be void.

11.9 Liens. In the event that liens are filed by any party in relation to the services, labor and materials being furnished by or on behalf of the Design/Builder on the Project, the Design/Builder agrees to have said liens discharged by substitution of a surety bond or otherwise, within ten (10) Days of receipt of written notice from the Owner. In the event such lien is not so discharged, the Owner shall have the right to discharge said lien and recover from the Design/Builder all costs associated therewith, including the Owner's attorney's fees incurred in having the lien discharged.

11.10 Compliance with Laws. In performing its obligations under this Agreement, the Design/Builder shall comply with all Applicable Law.

11.11 Continuing Duty. Acceptances, approvals, tests or inspections required or performed by the Owner or third parties shall not relieve the Design/Builder from any responsibilities or obligations to properly perform its services hereunder.

11.12 Non-Waiver. Failure to insist upon strict compliance with any terms, covenants or conditions hereof will not be deemed a waiver of such terms, covenants or conditions, nor will any waiver or relinquishment of any right or power hereunder at any one or more times be deemed a waiver or relinquishment of such right or power at any other time.

11.13 Integration. This Agreement contains the entire agreement between the parties concerning its subject matter and supersedes all oral or written agreements, negotiations, correspondence, documentation, and statements made before its acceptance and execution.

11.14 Severability. Any provision of this Agreement later held to be unenforceable for any reason shall be deemed void, and all remaining provisions shall continue in full force and effect.

11.15 Interpretation. All parties acknowledge and agree that this Agreement has been freely negotiated and that in any dispute over the meaning, interpretation, validity or enforceability of this Agreement or any of its terms or conditions, there shall be no presumption whatsoever against either party by virtue of that party having drafted this Agreement or any portion thereof.

11.16 Third Parties. All duties and responsibilities undertaken by the Design/Builder hereunder are for the sole and exclusive benefit of the Owner and the Design/Builder, and not for the benefit of any other person or entity. Except as provided in § 3.3, nothing herein shall be construed as an intent to create a

contractual or third party beneficiary relationship between the Owner and any of the Design/Builder's Subcontractors or Consultants.

11.17 Setoff. The Owner shall have the right to set off against the Design/Builder's account any damages that may accrue by virtue of Design/Builder's default under this Agreement, or any other agreement with the Owner, in addition to any amounts which are otherwise due and payable by the Design/Builder to the Owner under the terms of this Agreement, without prejudice to any other remedy Owner may have.

11.18 Responsibility. The Design/Builder shall be fully responsible to the Owner for acts and omissions of its employees, Subcontractors, Consultants, and others directly or indirectly furnishing services, labor, materials or equipment on their behalf.

11.19 Approvals. Notwithstanding anything to the contrary contained in this Agreement, the Owner's review, consent, approval, acceptance, or other action with regard to any documents or other matters required of Owner in such agreements, shall not be for the purposes of determining the accuracy or completeness of such documents and shall in no way create any liability on the part of the Owner, including for errors, inconsistencies or omissions in any such documents, nor shall any such review, consent, approval, acceptance, or other action alter, modify, or limit any of the Design/Builder's responsibilities hereunder or thereunder. Whenever the Owner's review, consent, approval, acceptance or other action is required or requested, such shall be granted, withheld and/or conditioned in the Owner's sole discretion, unless another standard is expressly otherwise stated in the provision that mandates, permits or allows the review, consent, approval, acceptance, or other action that is at issue.

11.20 Multiple Counterparts. This Agreement may be executed in multiple counterparts, each of which shall be enforceable to the same extent as an original.

11.21 Governing Law. The law of the State of Connecticut (without giving effect to its conflicts of laws principles) shall govern all matters arising under or related to this Agreement.

ARTICLE 12. LIST OF INCORPORATED DOCUMENTS

The following are incorporated into and made fully a part of this Agreement, as if attached to or repeated herein:

Exhibit A	Program and Project Requirements
	Optional: Exhibit A.1 Deliverables Requirements
Exhibit B	Designated Personnel, Consultants and Subcontractors
Exhibit C	Terms of Compensation
Exhibit D	Form of Amendment No. 1 Construction Proposal (Energy Services) Attachment No. 1
	Limitations on Submissions

This Agreement is entered into as of the dates below, made effective as of the date stated in Article 1.

YALE UNIVERSITY	**[DESIGN/BUILDER]**
J. Mike Bellamy	[Name]
VP for Facilities and Campus Development	[Title]
Date:_____	Date:_____

Anthony Kosior

Interim Leader of Facilities and Campus Development

Date:_____

EXHIBIT A

PROGRAM AND PROJECT REQUIREMENTS

A.1.1 Program and Project Requirements:

TBD

A.1.2 Specific Sustainability Requirements:

TBD

A.1.3 BIM Requirements: TBD

A. Format: Unless otherwise specifically agreed upon by the parties, the Design/Builder shall deliver the BIM Model in Autodesk Revit (.rvt) ("Revit") drawing formats. The BIM Model shall be in the current release version of Revit, or up to two (2) versions older than the current release version of Revit. The release version of Revit used by the Design/Builder shall remain constant throughout the Project.

B. Level of Development (LOD): Unless otherwise specifically agreed upon by the parties in writing, the Design/Builder shall furnish to the Owner a BIM Model that meets the minimum content requirements and associated authorized uses for LOD 300, as defined and set forth in AIA Document G202-2013, for at a minimum the model elements set forth below. The purpose of the issuance will be for coordination and clash detection purposes only. All major systems should be included in this model and will contain the accurate quantity, size, location and systematic relationship of all objects that will eventually be installed. The data about all objects will be filled in with all basic information. The Design/Builder shall furnish to Owner a progress version of the BIM Model at 50% completion of the Construction Documents Phase. Unless otherwise specifically agreed upon by the parties in writing, the Design/Builder shall furnish to Owner, as part of the Contract Documents, a BIM Model that meets the minimum content requirements and associated authorized uses for LOD 300 and as part of the Project Record Documents, a BIM Model that meets the minimum content requirements and associated authorized uses for LOD 400, as defined in AIA Document G202-2013. The model elements for LOD 300 and LOD 400 development shall include, but not be limited to the following building systems:

[ ] HVAC Distribution Systems including all Supply, Return, Insulation, Energy recovery units, VAV boxes, and Air Handling Units inclusive of hanger systems
[ ] All HW/CW/Steam distribution piping, and hanger systems with required insulation thicknesses.
[ ] Interior Mechanical Rooms with all associated equipment including all code and manufacturer's required clearances.
[ ] All Duct Risers including shafts, dampers and interior distribution with required insulation thicknesses.
[ ] Facility Power Generation to include Electrical Switchgear, Generator, PV cells, Transfer Switches and Electrical Panels.
[ ] Electrical Power Distribution to include all conduit of 1.5" diameter or greater and Electrical Closet with Panel Layout. Include bundled conduit systems with hanger systems for conduits smaller than 1.5" in diameter when 4 or more are bundled as a unit.
[ ] Light fixtures in ceilings using specific model as approved for installation.
[ ] Tel/Data Closets with Distribution and Wire Management Systems.
[ ] Building Support Plumbing Systems to include all domestic water equipment, storage tanks, plumbing fixtures, all traps, drains with required pitch and vent stacks.
[ ] Fire Protection Systems to include Siamese Connection, Building P.O.E., Pump Room with required clearances, Fire Protection Mains with Distribution, Sprinkler Head Location for required coverage.
[ ] All Building Conveying Systems to include Elevators, Lifts, Loading Dock equipment and associated Machine Rooms. All hydraulic piping and sumps.
[ ] Building Elements to include Superstructure with Columns, Beams, Load Bearing Walls, Floor Construction, Roof with required insulation thickness and pitch, Roof Drains with Piping, Exterior Shell Construction with Windows, Doors, Louvers, Interior Partitions with required Fire Ratings, Doors and associated operating and security devices, Stairs with enclosure and soffit, Mechanical Mezzanines and Raised Access Flooring.

C. Reliance: The Owner and entities furnishing services, labor, equipment or materials to the Project may rely on the accuracy and completeness of the above model

elements only to the extent consistent with the minimum data required for such element's LOD, even if the content of a specific model element includes data that exceeds the minimum data required for the identified LOD.

A.1.4 Target Construction Budget:

TBD

A.1.5 Schedule and Key Milestones.

A.1.5.1 Schedule. **[Optional: The preliminary schedule, dated [Date], is attached.]**

A.1.5.2 Key Milestones. The Design/Builder shall incorporate into its Schedule and perform its obligations in accordance with the following key milestones:

Final Design Documents……TBD

Final Construction Documents……TBD

Commencement of Construction……TBD

Substantial Completion……TBD

Final Completion……TBD

Commented [AR22]: This should be the core of the documents with monthly milestones to check-in and get approval to proceed on pre-design, design, costing, sub-selection, construction, etc

Commented [ML23R22]: See Project Agreement Section for more details

A.1.6 Owner's Designated Representative: Persons not affiliated with the Owner's Office of Facilities, including end-users, are not authorized to make decisions on behalf of the Owner with respect to the Project. The Owner's Designated Representative for the Project shall be: N/A

A.1.7 Meetings. Before commencing each Design Phase, the Design/Builder and Owner shall establish the type and frequency of regularly scheduled meetings for such phase. Attendance by remote conferencing will be subject to the Owner's sole discretion. Regular site visits and meetings to observe construction progress and inspect the Work as described in the Agreement will be scheduled an average of [TBD] during the Construction Phase.

EXHIBIT B

Designated Personnel, Consultants and Subcontractors

B.1 **DESIGN/BUILDER'S DESIGNATED REPRESENTATIVE.** THE DESIGN/BUILDER'S DESIGNATED REPRESENTATIVE(S) FOR THE PROJECT IS:

[Name(s) and Position(s)]

B.2 **DESIGN/BUILDER'S DESIGNATED PERSONNEL AND HOURLY RATES.**

Name]/[Position]	$[Rate]/Hour
[Name]/[Position]	$[Rate]/Hour
[Name]/[Position]	$[Rate]/Hour
[Name]/[Position]	$[Rate]/Hour

[OPTION: Hourly rates attached.]

B.3 **STAFFING PLANS.** ☐ THE DESIGN/BUILDER'S, CONSULTANTS' AND SUBCONTRACTORS' STAFFING PLANS ARE ATTACHED.

B.4 **DESIGN/BUILDER'S CONSULTANTS.** THE CONSULTANTS RETAINED BY THE DESIGN/BUILDER ARE:

MEP Engineer:	[Entity Name]
Designated Representative:	[Name]

[OPTION: Hourly rates attached]

Structural Engineer: [Entity Name]
Designated Representative: [Name]

[OPTION: Hourly rates attached]

Landscape Architect: [Entity Name]
Designated Representative: [Name]

[OPTION: Hourly rates attached]

Code Consultant: [Entity Name]
Designated Representative: [Name]
[OPTION: Hourly rates attached]
FFE Consultant: [Entity Name]
Designated Representative: [Name]

[OPTION: Hourly rates attached]

Discipline]: [Entity Name]
Designated Representative: [Name]
[OPTION: Hourly rates attached]

[Discipline]: [Entity Name]
Designated Representative: [Name]
[OPTION: Hourly rates attached]

[Discipline]: [Entity Name]
Designated Representative: [Name]
[OPTION: Hourly rates attached]

[Discipline]: [Entity Name]
Designated Representative: [Name]
[OPTION: Hourly rates attached]

B.5 **DESIGN/BUILDER'S SUBCONTRACTORS.** THE SUBCONTRACTORS RETAINED BY THE DESIGN/BUILDER ARE:

Subcontractor: [Entity Name]
Designated Representative: [Name]

Subcontractor: [Entity Name]

Designated Representative: [Name]

Subcontractor: [Entity Name]
Designated Representative: [Name]

B.6 **ADJUSTMENT OF RATES.** THE HOURLY RATES MAY BE REASONABLY ADJUSTED ON A YEARLY BASIS IN THE ORDINARY COURSE OF BUSINESS WITH THE APPROVAL OF THE OWNER, WHICH APPROVAL SHALL NOT BE UNREASONABLY WITHHELD. A PROMOTION OR CHANGE IN POSITION FOR DESIGNATED PERSONNEL OF THE DESIGN/BUILDER OR ITS CONSULTANTS SHALL NOT RESULT IN A CHANGE TO THE PROJECT RESPONSIBILITIES OR BILLING RATES OF SUCH DESIGNATED PERSONNEL, EXCEPT TO THE EXTENT CHANGES IN PROJECT RESPONSIBILITIES AND BILLING RATES ARE APPROVED IN WRITING BY THE OWNER, WHICH APPROVAL MAY BE GRANTED OR WITHHELD IN ITS SOLE AND ABSOLUTE DISCRETION.

EXHIBIT C

TERMS OF COMPENSATION

C.1 Compensation. The Design/Builder's compensation for the Work shall consist only of the Fee plus Reimbursable Expenses as set forth below in § C.1.1. C.1.1 Breakdown for portions of Fee:

Description	Fee	Basis	Reimbursable Expenses
Pre-Design Phase	Time & Expense	NTE	Included

Direct Aggregate Project Cost	Fee		Reimbursable Expenses
Design Phase	%		Included
Procurement Phase	%		Included
Construction Phase	%		Included

Performance Monitoring Phase	%		Included
Direct Mark Up	%		Included
Total Mark-up	%		

C.3 Extent of Authorization. The Design/Builder is authorized to perform solely the portion(s) or phase(s) of the Design/Builder's Work set forth below, which is the limit of the Owner's commitment and obligation to the Design/Builder's under the Agreement. Subsequent portion(s) and phase(s) of the Design/Builder's Work may be authorized in the Owner's sole discretion, and only by the issuance of an executed Change in Services. The Design/Builder acknowledges and agrees that the Owner has no obligation to authorize subsequent portion(s) or phase(s) or to compensate the Design/Builder for services undertaken but not authorized.

[Specify committed portion(s) or Phase(s) of Services]

EXHIBIT D

Amendment No. 1

ACCEPTANCE OF CONSTRUCTION PROPOSAL (Design Build- Energy Services)

This Amendment to the Agreement between the parties signing below shall establish the jointly agreed scope of the Work, Schedule and Contract Sum, in accordance with the terms of an agreement entitled: *Professional Services Agreement Between Owner and Design/Builder* dated

("Agreement").

Terms capitalized in this document are specifically defined in the Agreement and in the Contract Documents incorporated therein.

ARTICLE 1. CONTRACT SUM

The Design/Builder shall perform the Work on a time and expense basis not to exceed

and

/100 dollars ( ), which is the total amount payable for the performance of the Work in accordance with the Contract Documents, including this Amendment and its incorporated Exhibits as follows:

Commented [ML24]: Pre-design phase as a lump-sum with clear goals and outcomes established mutually.

Schedule A	Cost Summary and Cost Breakdown Worksheet pages, dated .
Schedule B	Bid analyses and recommended Subcontractors, including a cost summary of all Energy Conservation Measures broken down by trade based upon actual bids pages, dated .
Schedule C	List of Drawings, Specifications and Addenda on which the Contract Sum is based, pages, dated .
Schedule D	Schedule, pages, with a data date of .
Schedule E	Designated Personnel, Consultants, Subcontractors
Schedule F	Alternates, pages, dated .
Schedule G	Allowances, pages, dated .
Schedule H	Clarifications, pages, dated .

ARTICLE 2. CONTRACT TIME

The date of Substantial Completion established by this Amendment is .

ARTICLE 3. AUTHORIZATION TO PROCEED

Based on the representations made herein, the Design/Builder is hereby authorized to:

1) Conclude negotiations with the recommended bidders and notify Owner of the intent to award subcontracts accordance with the Agreement.

2) Commence construction activities in accordance with the Agreement.

3) This authorization will not constitute a waiver or alteration of any requirements or obligations of the Design / Builder as set forth in the Agreement, including without limitation those set forth in § 3.2.

YALE UNIVERSITY	**[DESIGN/BUILDER]**
[name]	[name]
[title]	[title]
Date:_____	Date:_____

Attachment No. 1

YALE UNIVERSITY

LIMITATIONS ON ARBITRATION SUBMISSIONS

This Attachment to the Agreement between the parties signing below shall be construed as the jointly agreed limitation on the powers and jurisdiction of any arbitrator or arbitration panel who may be appointed should Yale University ("Yale") opt to submit any claim or dispute between the parties to arbitration in accordance with the terms of a written agreement entitled Professional Services Agreement between Owner and Design/Builder ("Agreement").

I. Any case or issue or dispute submitted must be decided by a Panel of three (3) neutral arbitrators which shall be comprised of: 1) as Chair of the Panel, an attorney licensed to practice law in the State of Connecticut who has at least fifteen (15) years of litigation practice focused on clients in the design or construction industries, and; 2) two (2) persons with at least fifteen (15) years of experience in the construction or renovation of projects of comparable size and complexity to the Project that is the subject of the Agreement. Each of the three (3) arbitrators must be drawn from the roster of eligible and trained arbitrators maintained by the American Arbitration Association (or another reputable dispute resolution entity as may be designated by Yale), and each arbitrator must comply with all disclosure and disqualification procedures applicable to neutral arbitrators under the rules of the designated dispute resolution entity before being sworn to serve or act on the Panel. Each of the three (3) arbitrators must be within two (2) hours commuting distance from the hearing venue in New Haven, Connecticut as designated by Yale, and they must each be able to commit to contemporaneous blocks of hearing days for completion of the arbitration hearings and rendering an Award within no more than four (4) months of Yale's written decision to opt for an arbitrated resolution of the issue or dispute in question.

II. Neither the arbitrators nor the American Arbitration Association nor any other dispute resolution entity designated by Yale shall have any jurisdiction, power, or right to vary from the terms of this submission without the express written agreement of Yale. Unless otherwise so designated in writing by Yale, the arbitrators shall have no power or jurisdiction to do any of the following:

1. To permit or order the taking of depositions for purposes of discovery;

2. To permit or order the forensic recovery, production or searching of electronic files or documents from the parties or their agents or employees, although such power and jurisdiction shall be permitted to assist the parties in fulfilling or implementing their audit or document inspection rights as are set forth in the Agreement;

3. To permit or order any more than a maximum total of ten (10) hearing days on the merits of the case, with time split equally between the parties after taking into account all time spent by each party whether in presenting argument, direct examination, cross examination or otherwise by each such party;

4. To permit or order any type or amount of damage award or other remedy not expressly permitted in the Agreement, and expressly prohibiting any Award of punitive damages against any party.

5. To permit or order the enforcement of any subpoenas or document production requests against the parties or any non-party that are oppressive, overly broad or unduly burdensome, and in particular those which seek to impose production obligations for, or the forensic recovery of, e-mails or electronic documentation or files (although hard copy production of relevant and non-privileged documentation shall be permitted).

III. Unless otherwise designated by Yale, the Panel of Arbitrators shall at all times, as a matter of jurisdictional authority and obligation:

1. Conduct all hearings on the merits of the case in accordance with the Rules of Evidence as utilized in the Superior Courts for the State of Connecticut;

2. Apply and follow the written Agreement of the parties for the Project at issue;

3. Hear, deliberate and decide the case submitted as a Panel of three neutral Arbitrators, and, should any arbitrator be disqualified or become unable or unwilling to continue in those duties, the Panel shall permit the parties to substitute a replacement arbitrator with the same qualifications as the departing arbitrator pursuant to the terms of Paragraph I above;

4. Apply and follow any written stipulations of the parties; and,

5. Render and timely issue to the parties a "line item" and reasoned Award that sets forth the Panel's findings of fact, the clauses of the Agreement implicated by the dispute, the Panel's reasoning in reaching its findings and holdings, and the Panel's calculations of the specific elements of damages (if any) found by the Panel.

IV. The parties agree that this Attachment may be submitted to the Superior Court for the State of Connecticut for enforcement pursuant to, inter alia, Conn. Gen. Stat. § 52-410 and § 52-422 for any threatened or actual violation of its terms during any portion of the arbitration process, and that no party shall be obligated to demonstrate irreparable injury or inadequate remedy at law to obtain enforcement of the terms of the Agreement or this Attachment.

Attachment D: Project Cost Structure

Phase	**Fee Description**	**%**
Pre-Design	Time & Expense Not to Exceed	N/A

Design	Percentage of Estimated DAPC	
Procurement	Percentage of Estimated DAPC	
Construction	Percentage of Actual DAPC (Design & Procurement Trued up based on actual DAPC)	
Performance Monitoring	Percentage of Actual DAPC	
Direct Mark-Up	Percentage of Actual DAPC	
Total	Sum of Above	

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