

MASTER ENABLING AGREEMENT

COMMISSIONING SERVICES

This AGREEMENT is made and entered into this first day of July, 2023 pursuant to the Public Contract Code 10700, et seq., by and between the Trustees of the California State University on behalf of

<i>Campus, hereafter referred to as Trustees, and</i> California State University Office of the Chancellor	Amendment No.: N/A	Agreement No.: 22-647	Is agreement for Design Professional services: Yes (GP-8b)	Project No.: N/A
<i>Service Provider, hereafter referred to as Service Provider.</i> Digital Energy, Inc.	CSU Vendor ID No.: 2290	License No.: M21844		DIR No.: N/A

WITNESSETH: That the Service Provider in consideration of the statements and conditions herein contained, agrees to furnish labor, materials, and equipment and to perform work necessary to complete, in a skillful manner: The Service Provider shall provide new building and major renovation commissioning, retrocommissioning, and monitoring-based commissioning services for public works projects submitted by the California State University. This agreement is a master enabling agreement under which each campus and the administrative office of the California State University may engage the services of Service Provider as provided herein. Campuses and the administrative office shall execute a Service Order and Authorization to Proceed (Exhibit B) to secure Service Provider's commissioning services under this Agreement.

The Service Provider shall provide such services as more fully described in the following Rider, Exhibits, and Attachments, which by this reference are incorporated herein and made part of this Agreement:

Rider A	Agreement General Provisions,	consisting of six (6) pages;
Exhibit A	Project Area Scope Descriptions	consisting of four (4) pages;
Attachment 1	Sample Commissioning Scope	consisting of nineteen (19) pages;
Attachment 2	Sample Retrocommissioning Scope	consisting of ten (10) pages;
Attachment 3	Sample MBCx Scope	consisting of seven (7) pages;
Exhibit B	Service Order Authorization to Proceed Sample	consisting of one (1) page;
Exhibit C	Service Provider Rate Schedule	consisting of one (1) page;
Exhibit D	Energy Usage Intensity Report	consisting of one (1) page;
Exhibit E	Sample Commissioning Fee Table	consisting of one (1) page.

The term shall begin upon receipt of an executed Agreement from the Trustees and shall end as of June 30, 2027, with the option given the Trustees of extending the Agreement with the same terms and conditions for two (2) additional, two (2) year periods. Work elements started during the term shall continue to their completion and acceptance by the Trustees.

Service Provider shall not perform services in excess of the Agreement without prior written authorization to proceed from the Trustees.

Service Provider shall report to: California State University, Lindsey Rowell, Chief of Energy, Sustainability, and Transportation, (916) 402-1622.

The basic services amount to be expended under this Agreement shall be determined by the overall usage of each participation campus and the administrative office of the California State University. Payment shall be made in accordance with Rider A, Exhibit A, Attachment 1, Attachment 2, Attachment 3, Exhibit B, Exhibit C, Exhibit D, and Exhibit E.

Trustees of the California State University							Service Provider						
Campus California State University Office of the Chancellor							Firm Name Affiliated Engineers, Inc.						
By (Trustees' Authorized Signature) <i>[Signature]</i>							By (Authorized Signature) <i>[Signature]</i>						
Printed Name and Title of Person Signing Lindsey Rowell, Chief of Energy, Sustainability, and Transportation							Printed Name and Title of Person Signing Jai Agaram, President						
Address of Campus Project Administrator 401 Golden Shore; Long Beach, CA 90802							Address of Service Provider 555 Marin St., Ste. 230; thousand Oaks, CA 91360						
SCO Acct:	Fund	Sub Fund	Agency	Yr.	Ref/Item	Category	Program	Element	Component	Chapter	Fiscal Yr.	Legal Ref	
Fund Name			PS Account		PS Fund	PS Dept. ID	PS Program	PS Class		PS Project/Grant			
Amount Encumbered \$0.00			<i>I hereby certify upon my personal knowledge that budgeted funds are available for the period and purpose of the expenditures stated above.</i>										
Amount of Increase \$0.00			Signature of Accounting Officer				N/A \$0.00 MEA			Date			
Amount of Decrease \$0.00			<i>I hereby certify that I have examined the written Agreement and find the same to be in accordance with the requirements of California State University Contract Law. G. ANDREW JONES, General Counsel</i>										
Total Amount Encumbered \$0.00			By Attorney <i>[Signature]</i>				Date			08/01/2023			

This Agreement may be executed in counterparts all of which taken together shall constitute one and the same Agreement. The exchange of copies of this Agreement by electronic mail in "portable document format" ("PDF") form or by other similar electronic means shall constitute effective execution and delivery of this Agreement and shall have the same effect as copies executed and delivered with original signatures.

Rider A - Agreement General Provisions, Service Provider

1. Service Provider Relationship. Service Provider, in the performance of this Agreement, is an independent contractor and is not an employee, agent, or officer of the Trustees.
2. Payments. Payments under this Agreement shall be made in arrears of work increment completed to the satisfaction of the Trustees and upon submission of an invoice in CSU invoice format. If not otherwise specified payments for services rendered will be processed monthly upon presentation of invoice.
3. Services. Trustees may issue a written order with respect to the services to be performed under this Agreement at any time before the completion of the services. Trustees shall pay Service Provider an amount for such services as provided in this Agreement, or if not so provided, Trustees shall pay Service Provider a reasonable amount, which shall be agreed upon by the parties.
4. Service Provider shall not utilize any information, not a matter of public record, which is received by reason of this Agreement, for pecuniary gain not contemplated by the terms of this Agreement, regardless of whether Service Provider is or is not under contract at the time such gain is realized (Education Code Section 89006).
5. Ownership. The report, survey, or other product developed by Service Provider pursuant to this Agreement is the property of Trustees, and shall not be disseminated to others by Service Provider unless authorized by Trustees.
6. Termination for Convenience. Trustees may terminate this Agreement upon a three (3) business-day advance written notice to Service Provider. In the event of such termination, Service Provider shall be paid only for the work satisfactorily completed.
7. Termination for Cause. Trustees may terminate this Agreement for cause should Service Provider fail to perform as herein provided. In the event of such termination, Trustees shall be relieved of the obligation to make any payment to Service Provider and Trustees may proceed by other means with the work in any manner the Trustees deem proper.
8. Indemnification.
The Indemnification subsection below, next to the checked box, applies to this agreement, while the subsection next to the unchecked box does not apply to this agreement.
 - a. Provisions of item 8a shall apply if the agreement is with a Service Provider that does **not** qualify under the provisions of California Civil Code section 2782.8. The Service Provider agrees to hold harmless, defend, and indemnify the State of California, the Trustees of the California State University, the University, and the officers, employees representatives, and agents of each of them from any and all claims, damages, losses, causes of action and demands, and all costs and expenses incurred in connection therewith, including, but not limited to, attorneys' fees and costs resulting from or in any manner arising out of or in connection with any negligent act or omission or willful misconduct on the part of the Service Provider, its officers, agents, and employees, in the performance of this Agreement. This provision shall survive the expiration or termination of this Agreement.
 - b. Provisions of item 8b shall apply if the agreement is with a Service Provider that does qualify under the provisions of California Civil Code section 2782.8 and the scope of work is for design professional services. The Service Provider agrees to hold harmless, defend, and indemnify the State of California, the Trustees of the California State University, the University, and the officers, employees representatives, and agents of each of them from any and all claims, damages, losses, causes of action

and demands, and all costs and expenses incurred in connection therewith, including, but not limited to, attorneys' fees and costs to the extent arising out of, pertaining to, or relating to the negligence, recklessness, or willful misconduct on the part of the Service Provider, its officers, agents, and employees, in the performance of this Agreement. In no event shall the cost to defend charged to the Service Provider exceed the Service Provider's proportionate percentage of fault. However, notwithstanding the previous sentence, in the event one or more defendants is unable to pay its share of defense costs due to bankruptcy or dissolution of the business, the Service Provider shall meet and confer with other parties regarding unpaid defense costs. Service Provider's liability is not limited to recoverable insurance. This provision shall survive the expiration or termination of this Agreement.

The provisions of section 8b pertaining to the duty and cost to defend shall not apply to either of the following:

- 1) Any contract for design professional services per the provisions of California Civil Code section 2782.8, or amendment thereto, where a project-specific general liability policy insures all project participants for general liability exposures on a primary basis and also covers all design professionals for their legal liability arising out of their professional services on a primary basis.
 - 2) A design professional per the provisions of California Civil Code Section 2782.8, that provides design professional service and is party to a written design-build joint venture agreement and not the primary holder of the Trustees and Design-Builder contract.
9. Insurance Provisions. The Service Provider shall not commence work until the Trustees have received evidence of the insurance required in this section and approved it.
- a. Service Provider shall obtain the following policies and coverage. The insurance furnished by the Service Provider under this section shall provide coverage in amounts not less than the following, unless a different amount is stated in Exhibit A, Scope of Work Description:
 - 1) Comprehensive or Commercial Form General Liability Insurance:
On an occurrence basis, cover work done or to be done by or on behalf of the Service Provider and shall provide insurance coverage for bodily injury, personal injury, property damage, and contractual liability. The aggregate limit shall apply separately to the work. Limits of Liability:
\$2,000,000 General Aggregate
\$1,000,000 Each Claim - combined single limit for bodily injury and property damage.
 - 2) Business Automobile Liability Insurance:
On an occurrence basis, cover owned, scheduled, hired, and non-owned automobiles used by or on behalf of the Service Provider and shall provide insurance coverage for bodily injury, property damage, and contractual liability. Use Insurance Service Office (ISO) Form Number CA 0001 covering any automobile. Limits of Liability:
\$1,000,000 Each Accident - combined single limit for bodily injury and property damage.
 - 3) Workers' Compensation Insurance:
This insurance shall include Employers Liability limits of \$1,000,000 and other limits required under California law.
 - 4) Professional Liability Insurance:
Professional liability (errors and omissions) insurance on an occurrence basis is preferred, covering work done or to be done by or on behalf of the Service Provider and providing insurance

for professional liability in the amount of \$1,000,000 each occurrence. The Service Provider shall obtain and maintain professional liability insurance on a claims-made basis for no less than \$1,000,000 each claim and

\$2,000,000 annual aggregate, and certification of coverage shall be submitted to the Trustees upon signing of this Agreement. If the total contract amount exceeds \$1,000,000 the Service Provider shall renew and keep such insurance in effect for at least ten (10) years after the recordation of the notice of completion.

For any of the insurance described in the paragraphs above, the amount of limits can be satisfied by a combination of primary and excess or umbrella insurance.

- b. Insurers shall be authorized in the State of California to transact insurance and shall hold a current A.M. Best's rating of no less than **A: VII** or alternatively a carrier acceptable to the Trustees.

Verification of coverage shall be provided as follows:

- 1) The Service Provider shall submit to the Trustees copies of certificates of insurance and endorsements to the policies of insurance required by the Agreement as evidence of the insurance coverage.
 - 2) The scope of coverage shall be shown on the certificate of insurance.
 - 3) The Service Provider shall provide written notice of cancellation of coverage within thirty (30) days to the Trustees.
 - 4) The Service Provider shall notify the Trustees in writing of any material change in insurance coverage.
 - 5) Renewal certifications shall be timely filed by the Service Provider for coverage until the work is accepted as complete.
 - 6) Trustees reserves the right to require complete, certified copies of all required insurance policies, including endorsements required by these provisions, at any time.
- c. Insurance policies except for Workers Compensation and Professional Liability insurance shall contain, or be endorsed to contain, the following provisions:
- 1) For the general policies, the State of California, the Trustees of the California State University, the University, their officers, employees, representatives, volunteers, and agents shall be covered as additional insureds.
 - 2) For claims related to the work, the Service Provider's insurance coverage shall be primary insurance as respects the State of California, the Trustees of the California State University, the University, their officers, employees, representatives, volunteers, and agents. Insurance or self-insurance maintained by the State of California, the Trustees of the California State University, the University, their officers, employees, representatives, volunteers, and agents shall be in excess of the Service Provider's insurance and shall not contribute with it.
 - 3) The State of California, the Trustees of the California State University, the University, their officers, employees, representatives, volunteers, and agents shall not by reason of their inclusion as additional insureds incur liability to the insurance carriers for payment of premiums for such insurance.
- d. Additional Insurance Provisions
- 1) Any deductible under any policy of insurance required in this section shall be the Service

Provider's liability.

- 2) Acceptance of certificates of insurance by the Trustees shall not limit the Service Provider's liability under the Agreement.
 - 3) The Service Provider's obligations to obtain and maintain required insurance are non-delegable duties under this Agreement.
10. Personal Eligibility Certification. If the Service Provider is a natural person, the Service Provider certifies by signing this Agreement that s/he is a citizen or national of the United States or otherwise qualified to receive public benefits under the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (P.L. 104-193; 110 STAT. 2105, 2268-69), State of California Governor's Executive Order W-135-96.
11. Corporate Eligibility Certification. If the Service Provider is a corporation, the Service Provider certifies and declares by signing this Agreement that it is eligible to contract with the State of California pursuant to the California Taxpayer and Shareholder Protection Act of 2003 (Public Contract Code Section 10286, *et seq.*).
12. Nondiscrimination. In the performance of this Agreement the Service Provider and its consultants shall not deny the Agreement's benefits nor shall they discriminate unlawfully against any person on the basis of religion, color, ethnic group identification, sex, actual or perceived gender identity, age, physical or mental disability, medical condition, marital status, or age (over 40). Additionally, the Service Provider and its consultants shall insure that the evaluation and treatment of employees and applicants for employment are free of such discrimination as well.
- a. Service Provider shall comply with the provisions of the Fair Employment and Housing Act (Government Code Section 12900, *et seq.*), the regulations promulgated thereunder (California Code of Regulations, Title 2, Sections 7285.0, *et seq.*), and the provisions of Article 9.5, Chapter 1, Part 1, Division 3, Title 2 of the Government Code (Government Code Sections 11135-11139.5).
 - b. Service Provider shall permit access by representatives of the California Department of Fair Employment and Housing and the Trustees upon reasonable notice at times during normal business hours with at least 24 hours' notice, to its books, records, accounts, other sources of information, and its facilities as the Department or Trustees shall require to ascertain compliance with this Agreement.
 - c. Service Provider and its consultants/subcontractors shall give written notice of their obligations under this Agreement to labor organizations with which they have a collective bargaining or other agreement.
 - d. Service Provider shall include the nondiscrimination and compliance provisions of this Agreement in subcontracts to perform work under the Agreement (Government Code Sections 12990, 11135, *et seq.*, Title 2, California Code of Regulations, Section 11105)
13. Drug Free Workplace Certification. The Service Provider hereby certifies compliance with Government Code Sections 8355, 8356, and 8357 in matters relating to providing a drug-free workplace. In accordance with Government Code Section 8355, the Service Provider shall:
- a. Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations;
 - b. Establish a Drug-Free Awareness Program to inform employees about all of the following:
 - 1) The dangers of drug abuse in the workplace,
 - 2) The Service Provider's policy of maintaining a drug-free workplace,
 - 3) Any available counseling, rehabilitation, and employee assistance programs, and

- 4) Penalties that may be imposed upon employees for drug abuse violations;
 - c. Require that each employee engaged in the performance of the Agreement be given a copy of the statement required by subpart A, and require that each employee, as a condition of employment on the Agreement, agree to abide by the terms of the statement.
14. Disabled Veteran Business Enterprise. Responsive to direction from the State Legislature (Public Contract Code Section 10115, *et seq.*), the Trustees are seeking to increase the statewide participation of disabled veteran business enterprises in contract awards. To this end, Service Provider shall inform the Trustees of any contractual arrangements with consultants or suppliers that are certified disabled veteran business enterprises.
 15. Assignment. Service Provider shall not assign benefits or delegate duties under this Agreement in whole or in part, nor assign any moneys due or to become due hereunder without the written consent of Trustees.
 16. Successors. The provisions of this Agreement shall extend to and be binding upon and inure to the benefit of the heirs, executors, administrators, successors, and assigns to the parties hereto.
 17. Notice. Notice for either party may be served by delivering it in writing to the party, or by depositing it in a U.S. mail deposit box with postage fully prepaid addressed as shown within the information block of the Agreement page. Nothing herein shall preclude the giving of notice by personal service.
 18. Audit. If the Agreement exceeds \$10,000, the contracting parties shall be subject to the examination and audit of the State Auditor of the State of California and the California State University Auditor for a period of three years after final payment under the Agreement. This examination and audit shall be confined to those matters connected with the performance of this Agreement, including, but not limited to, the cost of administering this Agreement (Government Code Section 8546.7).
 19. DIR Registration. In accordance with Labor Code Section 1720, *et seq.*, the Service Provider shall register with the Department of Industrial Relations (DIR) for this project and pay at least the prevailing wages on services/work aspects where a prevailing wage applies. Such services and/or work aspects include, but are not limited to, the Service Provider or its sub-consultant's provision of geotechnical studies, potholing involving digging, site surveying and/or construction Inspector of Record services as defined by the DIR.
 20. Agreement Changes. Alteration or variation of the terms of this Agreement shall not be valid unless made in writing and signed and dated by the parties. Oral representations, understandings, or writings not expressly incorporated in the Agreement are void. Unless identified within Exhibit A, Scope of Work, under a separate sub-heading entitled 'Modifications to Agreement', it is the intent of the Trustees to use the standard published form of this Agreement and Rider A without modification. The Agreement and Rider A shall not be modified without review and concurrence by CSU Office of General Counsel.
 21. Offshoring of CSU Contract Work. Service Provider warrants it certified under penalty of perjury in its bid for this Agreement that the Agreement, and any subcontract performed under the Agreement, will be performed solely with workers within the United States; and if this Agreement, and any subcontract performed under this Agreement, will not be performed solely with workers within the United States, Service Provider described in its bid any parts of the work to be performed by workers outside of the United States. Further, Service Provider warrants no work will be performed under the Agreement with workers outside the United States, except as described in Service Provider's bid. If Service Provider or its sub-supplier performs the Agreement with workers outside the United States during the life of the Agreement, and Service Provider did not describe such work in its bid, Service Provider acknowledges and agrees that:
 - a. CSU may terminate the Agreement without further obligation for noncompliance, and
 - b. Service Provider will forfeit to CSU the amount CSU paid for the percentage of work that was performed

with workers outside the United States and not described in Service Provider's bid.

End of Rider A

THE CALIFORNIA STATE UNIVERSITY

EXHIBIT "A" – PROJECT AREA SCOPE DESCRIPTIONS Digital Energy, Inc.

PROJECT AREA OBJECTIVES

New Building/Major Renovation Commissioning (Cx) Objectives

By statute, Title 24 of the California Code of Regulations (CCR), Part 6 - California Energy Code, and Part 11 - California Green Building Standards (CALGreen), requires a building system commissioning effort for new construction with conditioned space of 10,000 SF and greater. Commissioning shall be included in addition to the requirements of the Title 24 CCR, for all California State University (CSU) major capital construction projects.

For the New Building/Major Renovation commissioning project areas, or where another design team may be involved, the CxP acts as a campus agent and as a consulting campus advisor to the design team and contractor on issues that affect commissioning. The CxP's role is advisory, and in new building commissioning and other projects where another design review takes place, complementary to the Mechanical/Electrical Systems Reviewers' scope of work. In all applicable cases, the two parties shall coordinate to ensure no redundant reviews are performed. For Retrocommissioning and Monitoring Based Commissioning project areas, the CxP's role is usually not just advisory, but also implementation-focused to both identify and implement measures.

1. During the **pre-design activities**, the CxP will be expected to work with the campus project team, including occupants and controls end users, to define Owner's Project Requirements (OPR) suitable for use in a project RFQ/RFP. In close collaboration with CSU and the campus, the CxP may be asked to help advise and develop project and design goals, measurable performance criteria, budgets, schedules, success criteria, owner's directives, and supporting information for the OPR to form the basis from which all design, construction, acceptance, and operation decisions are made during the project lifecycle.
2. During the **design phase**, the role of the CxP will be to develop commissioning specifications and testing plan recommendations for the design team.
3. During **construction**, the CxP will be expected to monitor to ensure commissioning-related tasks are completed consistent with the approved Construction Documents and the commissioning plan, as well as facilitate building operator training.
4. During the **one-year post-occupancy period**, the CxP will be expected to provide the completed Systems Manual and any requested LEED documentation, as well as verify that the building is operating as designed, by documenting energy use intensity for the first twelve (12) months of operations in the format specified in Exhibit B and providing this to both campus and CPDC.

Retrocommissioning (RCx) Objectives

CSU views Retrocommissioning as an important process to restore optimal functionality and efficiency to aged buildings. Over time certain systems or control components of a building can become uncalibrated and adversely affect the occupant comfort and efficiency of a building's operations. RCx pinpoints these problems and seeks to remedy them.

1. During the **planning phase**, the CxP will be expected to work with the campus project team, including occupants and controls end users, to define Owner's Project Requirements as well as develop a Retrocommissioning Plan.
2. During the **investigation phase**, the role of the CxP will be to conduct a systematic analysis of the building(s)' performance through observation, review of building documents and O&M practices, and trending and testing of building systems.
3. During the **implementation phase**, the CxP will be expected to develop an Implementation Plan for the measures selected from the investigation phase, implement said measures, and verify that the operational goals were achieved.
4. During the **handoff phase**, the CxP will be expected to provide the Final Report and Systems Manual such that the campus building operators have sufficient materials to monitor and maintain the implemented RCx measures.

Monitoring-Based Commissioning (MBCx) Objectives

The goal of an MBCx process is to maintain existing improvements and implement further improvements to building performance over time. Monitoring-based commissioning is defined as the implementation of an ongoing commissioning process with focus on monitoring and analyzing large amounts of data on a continuous basis.

1. During the **planning phase**, the CxP will be expected to work with the campus project team, including occupants and controls end users, to establish the technical plan and define the scope of how MBCx will be implemented using the energy management system (EMS) and/or energy information system (EIS).
2. During the **EMS/EIS configuration phase**, the role of the CxP will be to configure and calibrate necessary data points (e.g. fault detection, energy savings), user interfaces, and sensors for the accurate tracking of data over the course of the project.
3. During the **implementation phase**, the CxP will be expected to identify issues and opportunities for corrective action and work with the campus project team to implement these measures, and update facility documentation accordingly, as well as deliver a final report and necessary training.

APPLICABLE SYSTEMS AND ASSEMBLIES TO BE COMMISSIONED

The following includes a sample list of items anticipated to be included in any one of the three project areas.

HVAC Systems and Equipment Controls

- Chilled water system (chiller, cooling tower, piping, pumps)
- Heating water system (boilers, piping, pumps)
- Under floor air distribution system
- Air handlers (including minimum outside air control,
- CO2 monitoring, heat recovery, humidification)
- Hydronic piping (including air separators and expansion tanks)
- Ductwork
- Thermal comfort, temperature and humidity control
- Variable speed drives
- Outside air valves
- Perimeter heaters
- Unit heaters
- Air terminal boxes
- Variable refrigerant flow (VRF) system
- Computer room air conditioning units
- Fan coil units
- Restroom exhaust system
- Misc. exhaust fans
- Garage exhaust fans
- Building automation and control system (BAS)
- Data acquisition system
- Atrium smoke control system
- Radiant floor heating
- TAB work
- HVAC and envelope differential pressure relationship

Electrical Systems

- Scheduled lighting controls
- Exterior lighting controls
- Daylight dimming controls
- Lighting occupancy sensors
- Wire and cable
- Medium voltage shielded cable
- Wiring devices (switches and outlets)
- Switchgear
- Motor control centers
- Transformers
- Variable frequency drives
- Ground fault
- Secondary grounding
- Low voltage metal-enclosed switchgear
- Bus duct
- Emergency power generator system and ATS
- Whole building power outage integrated test
- Photovoltaics
- Battery Energy Storage Systems

Laboratory and Clean Room

- General lab exhaust systems

- Lab and room pressurization control
- Air terminal units (supply and exhaust valves)
- Room differential pressure controls and equipment (exhaust and makeup fans and terminals)
- Fume hood functionality (not including ASHRAE 110 tests or other certifications)
- Hood and process exhaust systems
- Exhaust scrubbers
- Biological safety cabinets
- Safety cabinets
- Cold rooms
- Bio-waste sterilization
- Lab vacuum pumps
- Lab air compressor
- Cleanroom fan filter units
- Cleanroom makeup air units
- Cleanroom certification
- Pure water systems
- Process gas systems
- Process coolers

Special Systems

- Automatic window shades
- Elevators
- Electric coiling doors and grills
- Loading dock lift
- LEED features to meet desired level of certification through:
 - Energy and Atmosphere Cx credits
 - M&V Credits
 - Environmental Quality credits
 - Water Efficiency credits
- Living Building Challenge features to meet desired petals:
 - Place petal
 - Water petal
 - Energy petal
 - Health + Happiness petal
 - Materials petal
 - Equity petal
 - Beauty petal

SPECIFIC SCOPE EXAMPLES

Selected respondents will be required to develop project-specific scopes of work, budgets, and schedules for each campus project. These project-specific items will be negotiated with individual campuses as they initiate projects requiring commissioning services. Examples of potential specific scope documents in each of the three project areas are included for reference and are expected to be used as a starting point for each campus-specific scope of work. Respondents may use the documents to inform their SOQs.

Attached:

1. Example New Building Commissioning Scope of Services
2. Example Retro-Commissioning Scope of Services
3. Example Monitoring Based Scope of Services

End of Exhibit “A”

THE CALIFORNIA STATE UNIVERSITY
Attachment 1 - Commissioning Scope of Work
Digital Energy, Inc.

(Sample Only – Campus to update or provide actual scope)

CSU Commissioning (Cx) Requirements and Scope

The objective of the CSU commissioning process is to provide a systematic quality assurance process that spans the entire design and construction process, including assisting the campus define Owner’s Project Requirements (OPR) verifying and documenting that building systems and components are planned, designed, installed, tested, operated and maintained to the applicable codes and standards as well as meet CSU’s project requirements.

The Service Provider engaged for this work is hereby designated as the Commissioning Provider (CxP) for the project. In this role the CxP acts as a campus agent and as a consulting campus advisor to the design team and contractor on issues that affect commissioning. The CxP’s role is advisory, and in new building commissioning, complementary to the Mechanical/Electrical Systems Reviewers’ scope of work. The two parties shall coordinate to ensure no redundant reviews are performed.

The Architect/Engineer and Contractor under their own separate contracts with the Campus are the respective Architect/Engineer-of-Record and Contractor-of-Record. The CxP shall perform to the selected scope of work using the most current CSU Commissioning Guidelines (available through the CSU CPDC [Resource Library](#)) as a reference. The CxP shall seek direction from the campus where guideline or scope requirements relative to the specific project are not applicable.

New Building/Major Renovation Commissioning (Cx) Objectives

By statute, Title 24 of the California Code of Regulations (CCR), Part 6 - California Energy Code, and Part 11 - California Green Building Standards (CALGreen), requires a building system commissioning effort for new construction with conditioned space of 10,000 SF and greater. Commissioning shall be included in addition to the requirements of the Title 24 CCR, for all California State University (CSU) major capital construction projects.

The new building commissioning scope of work will involve the CxP from pre-design through its completion and a one-year post-occupancy period thereafter.

1. During the pre-design phase, the CxP shall work with the campus project team to define Owner’s Project Requirements suitable for use in a project RFQ/RFP.

2. During the design phase, the role of the CxP is to develop commissioning specification and testing plan recommendations for the design team.
3. During construction, the CxP shall monitor to ensure commissioning-related tasks are completed consistent with the approved Construction Documents and the commissioning plan, as well as facilitate building operator training.
4. During the one-year post-occupancy period, the CxP shall provide the completed Systems Manual and any requested LEED documentation, as well as verify that the building is operating as designed.

Scope of Work

Campus project team shall determine which scope of work is applicable to the project. Note that all new buildings with more than 10,000 SF of conditioned space are required to be commissioned (i.e. subject to the Cx Scope of Work) per Title 24 Parts 6 and 11.

1. Phase 1: Pre-Design
 - a) Deliverables
 - i. Owner's Project Requirements
 - b) Activities
 - i. Develop an Owner's Project Requirement document (OPR) to memorialize the project's functional requirements, expectations of building use and operation as it relates to systems being commissioned, consistent with Title 24 of the CCR, Part 6- California Energy Code, CALGreen, and CSU major capital project requirements. Refer to the CSU Owner's Project Requirements Guide, available through the Resource Library.
 - ii. Actively coordinate the commissioning work effort during pre-design and all design phases.
2. Phase 2: Design
 - a) Deliverables
 - i. Commissioning Plan
 - ii. Meeting with design team and campus
 - iii. Updated OPRs as appropriate
 - iv. Phased Cx Reviews (reference Table 1)
 - v. Commissioning Specifications
 - vi. Participate in controls integration meetings, as requested
 - b) Activities
 - i. Table 1 below provides an overview of Commissioning Activities during the design phase, which are detailed further below.
 - ii. Develop commissioning plan and specification recommendations for design team use. The CxP's role here is to provide advisory support.

The project A/E retains record authority for the functionality and appropriateness of the design.

- iii. Conduct a design phase planning and scoping meeting with the design team and campus.
- iv. With each design package from the Design Team, review and update the OPR as needed. Review the Basis of Design (BOD) and recommend changes to make it accurate.
- v. Perform reviews of the design and specifications against the OPR and BOD. Coordinate with Mechanical and Electrical Systems Reviewers to ensure reviews are not redundant. Submit comments and review and adjudicate concerns and responses with the Owner and Design Team. Backcheck the incorporation of comments in the next design submission.

(1) Table 1 provides guidelines for the reviews to be conducted by the CxP. Work with campus team to determine level of depth and rigor desired.

Table 1: Cx Review Phases

Phase	Systems to be Reviewed and Commented On	Scope of Reviews	Review Rigor
Schematics / Concepts	Systems that have some level of development	Moderate: Review is high level, looking for areas where the OPR may be difficult to achieve. Rigorous: Moderate, plus make comments where the concepts could be enhanced.	<input type="checkbox"/> moderate <input type="checkbox"/> rigorous

Phase	Systems to be Reviewed and Commented On	Scope of Reviews	Review Rigor
Design Development	HVAC, controls, lighting controls, domestic water heating, emergency power, building enclosure, fire alarm, fire protection, electric gear, security, telecom, other:	Moderate: Primarily review for commissioning facilitation and operations and maintenance issues and obvious areas where OPR may not be met. Rigorous: Moderate, plus a deeper look into OPR compliance, review the BOD, energy efficiency, indoor environmental quality, functionality for tenants, environmental sustainability, life cycle cost (qualitative), durability and safety.	<input type="checkbox"/> moderate <input type="checkbox"/> rigorous
Construction Documents-Mid	HVAC, controls, lighting controls, domestic water heating, emergency power, building enclosure, fire alarm, fire protection, electric gear, security, telecom, other:	Same as Design Development. And, for Moderate: Review training, O&M documentation and commissioning requirements. Rigorous: Moderate, plus review ongoing monitoring requirements, identify vague and incomplete issues likely to cause change orders and extra effort on confirming controls are well thought out, include feedback from campus facilities end-users, completely defined and workable.	<input type="checkbox"/> moderate <input type="checkbox"/> rigorous
Construction Documents-Late	Same as above, except:	Same as Mid-Construction Documents.	<input type="checkbox"/> moderate <input type="checkbox"/> rigorous

- (2) Reviews for constructability and physical coordination are not explicitly in the CxP's scope, but issues observed shall be documented.
- (3) Review to verify compliance with building codes are not explicitly in the CxP's scope, but issues observed shall be documented.
- vi. Facilitate, participate in and track outcomes of controls integration meetings with the CxP and appropriate members of the design team and controls representative of the contractor if known. Review control system features, strategies, sequences and interlocks between systems and disciplines, etc., identify and facilitate resolving conflicts and see they are incorporated into the design.
- vii. Confirm that the design team develops clear, complete and rigorous: a) sequences of operation for all dynamic equipment, b) Fire alarm response matrix, c) Emergency power response matrix, by approving formats and completed documents from the design team.
- viii. Develop project specific commissioning specifications.
 - (1) The commissioning specifications shall provide a clear and complete description of the commissioning process and the roles and responsibilities of the Contractor.
 - (2) Definitions, responsibilities by party, submittal requirements, coordination, meetings, process and requirements relative to installation, construction checklist creation and execution, start-up, test-readiness confirmation, functional test development and execution, deferred and seasonal testing, issue and non-conformance, training of Owner personnel, O&M documentation, systems manual requirements, documentation and closeout. Identify by equipment, who is writing construction checklists and functional tests, approving the forms, directing, executing, and documenting tests, etc.
 - (3) The above elements applicable to all systems commissioned shall be provided in a General Commissioning Requirements section, provided in draft during Design Development.
 - (4) Specific testing and monitoring (trends), sampling and other unique requirements shall be developed for each system in a separate appropriate specification section, e.g., mechanical, electrical, plumbing, fire alarm, envelope or enclosure.
 - (5) A few representative construction checklists and functional tests shall also be provided for reference.
 - (6) The commissioning specifications shall be updated as required for the 100% construction documents submission.
- ix. Create a Construction Phase Commissioning Plan.
 - (1) The Cx Plan shall augment the process given in the Cx specifications, providing some repeat of the general commissioning requirements.

- (2) Additionally, provided shall be more specificity for this project, including more detail on the communication, management, and access reporting and approval protocols, the submittal process, field observations, construction checklist and functional testing development, coordination, execution and documentation, air and water balancing management, meeting schedule and frequency, including controls integration meetings, communication protocols, scheduling issues, progress reporting, testing in phases, issue management, subcontractor task delineation, training, systems manual development, etc.
- (3) The Cx Plan document does not include the construction checklists and functional tests which are developed during the Construction Phase, though samples may be part of the plan.

3. Phase 3: Construction

a) Deliverables

- i. Planning meeting with Campus and General Contractor
- ii. Updated Commissioning Plan
- iii. Create and submit Cx schedule to GC
- iv. Cx kick-off meeting with GC and subcontractors
- v. Develop construction checklists and functional tests
- vi. Controls integration meeting
- vii. Commissioning issues log/progress reports
- viii. Commissioning coordination meetings
- ix. M&V Plan
- x. Functional testing reports
- xi. Facilitation and verification of operator training
- xii. Documentation of Operations and Maintenance Manual review

b) Activities

- i. Conduct a planning meeting with the Campus and General Contractor/Construction Manager.
- ii. Update the Construction Phase Commissioning Plan.
- iii. Create a Cx schedule and have the contractor integrate it into the construction schedule.
- iv. Conduct a Commissioning kick-off meeting with General and subcontractors. Review the Cx Plan and specifications and process highlighting the trades' responsibilities.
- v. Review Contractor submittals.
 - (1) Review and comment for compliance with the plans, specifications, OPR and for commissioning facilitation for the equipment and systems within scope, including but not limited to air and water balancing agenda, HVAC systems, building automation system, lighting controls, emergency power and fire alarm response matrices.

- (2) Review for information only and to assist in developing construction checklists and functional tests for the applicable equipment and systems, such as coordination shop drawings and piping.
- vi. Prior to controls programming, hold a controls integration meeting where the submittal review comments of controls sequences and drawings are discussed and issues resolved. Track and submit issues.
 - (1) Test procedures shall be developed uniquely for each project and are composed of repeatable, step-by-step narrative procedures and include the test prerequisites and set up conditions, the test process of perturbing or observing the system or set points, the expected outcomes, the acceptance criteria and a place to record the results.
 - (2) Test procedures shall confirm every sequence in the building automation system sequences of operation and relevant features and sequences of on-board controllers including staging, interlocks to other equipment, alarms, manual operation, time of day schedules, off-hours operation, fire mode, loss of power and equipment failure, etc.
 - (3) All larger, more complex, process critical or life-safety equipment shall be individually tested. Testing only a sample of some equipment or assemblies may be allowed where such equipment or assemblies are small in physical size or importance, are numerous and are not complex or critical for process or life-safety.
 - (4) Systems that are monitored through an energy management system (EMS) shall be trended by the CxP after manual testing is complete. If there is no EMS, the CxP shall provide and install data loggers. Trend requirements will be included in the functional test forms. Trends shall confirm proper operation of all major control loops, equipment staging and time of day scheduling, etc.
 - (5) Provide functional test procedures to the contractor early and so they can execute the tests on their own prior to formal functional testing with the CxP. Incorporate Contractor comments into the forms.
 - (6) Test procedures developed by the Contractor or vendors shall be approved by the CxP.
- vii. Review minutes of Campus, Architect, Contractor meetings to keep abreast of project progress.
- viii. Review requests for information and change orders of commissioned equipment. Comment as warranted to maintain the OPR.
- ix. Develop and manage the Commissioning Issues Log in a spreadsheet or database application that allows sorting and filtering and efficient displaying and printing of data. Keep log updated as issues are identified. Regularly submit the log to the Campus and Contractor.
- x. Facilitate quicker and better resolution of issues by assisting the project team with resolution of issues. The CxP is not responsible for

issue resolution, but is expected to provide input when they may have a unique and valuable perspective due to their expertise or onsite familiarity with the project and when such input can be readily done without much analysis.

- xi. Conduct construction site observations beginning when the commissioned equipment is shipped to the site.
 - (1) Make observations about equipment model and features meeting submittal requirements, equipment condition, installation, scheduling, coordination and in the proper utilization of construction checklists. The observations will check things randomly in construction checklists and will target other areas deemed necessary by the CxP.
 - (2) Document issues in the Cx Issues Log that require addressing by the Contractor and forward the log to the Campus and Contractor in a timely manner. Construction progress reports are not desired.
 - (3) Frequency of visits must be sufficient for the CxP to keep abreast of progress and to allow for catching significant issues early. Attendance at part of major equipment startup is desired. Propose the frequency and number of visits by discipline.
- xii. Conduct regularly scheduled commissioning coordination meetings. Take and distribute minutes. Propose meeting frequency. For example, meetings may include planning and kickoff meetings, plus one meeting per month once ductwork has been set and twice a month once the first major piece of HVAC equipment is started. When testing begins, meetings may be weekly until occupancy. Note, for small projects these frequencies may need significant compression.
- xiii. Submit commissioning progress reports to the Campus and Contractor at one half the frequency as commissioning meetings.
- xiv. Fully develop the M&V Plan. Confirm that all points and data streams are installed and recording properly.
- xv. Review startup and factory test reports of commissioning equipment and confirm compliance with the manufacturer's recommendations and good practice.
- xvi. Observe some of the air and water balancing work sufficient to be reasonably confident it is being done correctly. Review the balance report. Back check a 5% sample of the work with the balancer using their equipment.
- xvii. Confirm formal functional test readiness through field observation, review of start-up reports and construction checklists, observation of control system and equipment operation, including trending and when required review of contractor's pre-tests of system operation.
- xviii. Schedule, direct and document functional testing.
 - (1) The Cx Team shall utilize observations, active tests and trending or monitoring of systems and assemblies to evaluate compliance with

the construction documents and OPR. The testing rigor required is described in the functional test procedure articles above.

- (2) Prior to or at the beginning of testing, critical sensor and actuator calibrations and building automation system graphics shall be confirmed accurate.
 - (3) CxP shall write, direct, execute and document tests on approved test forms per the Testing Responsibility (Table 2) below. Record issues on the Issues Log and forward to Contractor and Campus in a timely manner. CxP shall witness tests executed and documented by others per the testing table below sufficient to be reasonably confident they are being done properly and shall review completed test reports.
 - (4) Sampling. Testing only a sample of like equipment shall be conducted as follows (Contractor testing described below is in addition to the Contractor pre-tests):
 - For all sampling testing by the CxP, if there are any failures, the Contractor shall make needed corrections to all like units and to units with the same or similar elements that failed in the entire project and then show the CxP how the units' corrections and programming were made and shall document random retesting of the rest of the project of the same percentage the CxP originally tested using the CxP's forms. CxP will review retesting documentation and may use allotted retesting hours for random back-checking of the corrections.
 - Terminal boxes or radiators (air or water): CxP tests all sequences and features on 10-30%. On all units CxP executes building automation system reports or queries during heating and cooling mode to verify proper valve and damper actuation and room temperature control.
 - Lighting occupancy sensors: CxP shall test 20-30% with the Contractor, Contractor tests and documents the balance.
 - Daylight dimming controls: CxP shall test 30-50% with the Contractor, Contractor tests and documents the balance.
 - Building enclosure elements as requested.
 - Other equipment as requested.
 - For the balance of equipment the Contractor tests alone, the CxP reviews the test reports and field backchecks for 5-20%.
- xix. Trend logs of BAS controlled equipment over a week's time at no greater than 5-minute intervals of temperature, flow, speed, pressure, position, status, setpoints, etc. shall be utilized to confirm proper operation of all primary control loops (space, coil, duct and water temperature and duct and room pressure control, speed, resets, economizer functions, major equipment staging, etc.).

- (1) The CxP shall view and analyze trends and record deficiencies in the Issues Log. The Contractor shall set up the trends specified by the CxP.
 - (2) Once systems are working properly, the CxP shall print graphs demonstrating the proper operation of the primary control loops of all equipment and submit with the active functional testing reports.
 - (3) When critical data is not available through a BAS, monitoring and recording of performance data is accomplished by using stand-alone data loggers provided, set and analyzed by the CxP.
- xx. Determine with Campus the maximum number of hours to be spent on CxP retesting of deficiencies in this scope.
- xxi. Completed tests shall be submitted to the Owner.
- xxii. Facilitate and verify operator training.
- (1) Develop detailed training agendas for each system and assembly and provide to the Contractor to use during their training. From Campus input, include desired training rigor and attendee type. Alternatively, the CxP may review agendas developed by the Contractor. Include a place to mark each concept taught and have a log of attendees.
 - (2) Develop questionnaires for the trainees that evaluate the training and attach to the agenda submitted to the Contractor.
 - (3) If desired by Campus, the CxP may attend a few of the trainings.
 - (4) Review completed agendas and questionnaires to confirm training adequacy. Submit documentation of this review.
- xxiii. Review O&M manuals for compliance with the specifications parallel with the A/E review. Submit documentation of this review with any deficiencies.
- xxiv. Confirm that the as-built drawings for specified systems have been submitted. CxP is not required to verify accuracy.

Table 2: Testing Responsibility Table (adapt to scope of project as needed)

Equipment	Write Tests	Direct Tests	Execute Tests	Document Tests	Witness Test Only
HVAC & controls	CxP	CxP	Contr	CxP	----
Lighting controls	CxP	Both**	Contr	Both**	----
Electrical gear	Certified testing co. of Contr.	Certified testing co. of Contr.	Certified testing co. of Contr.	Certified testing co. of Contr.	CxP (sample*)
Fire alarm & protection	CxP	Vendor	Vendor	Vendor	CxP (sample*)

Equipment	Write Tests	Direct Tests	Execute Tests	Document Tests	Witness Test Only
Plumbing	CxP	CxP	Contr	CxP	----
Security & Intercom	CxP	CxP	Contr	CxP	----
Building enclosure	CxP	CxP	Contr	CxP	----
Laboratory process	CxP	CxP	Contr	CxP	CxP (see exceptions)
Other:					

Contr = Contractor

**Both, indicates that some equipment has shared responsibility as delineated in the Sampling article above.

4. Phase 4: Post-Occupancy

a) Deliverables

- i. Systems Manual
- ii. LEED Certification documentation (if requested)
- iii. Peak load seasonal testing report
- iv. 10-month post-occupancy report
- v. Updated Commissioning report

b) Activities

- i. The CxP shall stay engaged for one year after project completion.
- ii. Finish outstanding functional testing and other incomplete tasks listed in the Construction Phase, including facilitating the resolution of outstanding issues.
- iii. Finish compiling the Systems Manual. The CxP receives System Manual elements electronically from others and provides some elements themselves, as noted below, and compiles them into one electronic suite of pdf documents, all organized, bookmarked and hyperlinked and submits to Campus. Bookmarks must be down to the equipment level for submittals and O&Ms, startup reports, test record, etc. The Systems Manual is also provided in hard copy to the Campus, with the Contractor submitting their contributions directly to the Campus, as does the CxP (one copy provided). The contents of the Systems Manual generally follow ASHRAE Guideline 0. Work with Campus to determine the systems to be included in the Systems Manual, which may not include all of the commissioned systems.

(1) Systems Manual Contents

- o Table of Contents (bookmarked and hyperlinked)
- o Executive Summary
- o OPR and System Narratives
 - o OPR (by CxP or Campus) and Systems Narratives (by design team)

- System flow diagrams or schematics (when part of design documents, by design team)
- Operating Requirements
 - Owner approved building occupancy schedule (by CxP).
 - Equipment run-time schedules (by CxP).
 - Minimum outside air requirements (general building wide) (by design team).
 - By space: use, temperature, humidity, lighting level and any special noise, pressure, return air, air change requirements (by design team).
- (2) Operating Parameters and Procedures
 - As-built sequence of operations for all equipment, including those with standalone controllers (by contractor).
 - As-built control drawings, including points list (by contractor).
 - A list of all user-adjustable set points and reset schedules, their purpose, and range of reasonable adjustments with energy implications when adjusting them—including the central building automation system and packaged equipment controllers (by CxP).
 - A description of and rationale for all major energy-saving features and strategies with operating instructions and caveats about their function and maintenance (by CxP).
 - Fire and emergency power response criteria in matrix format, including narratives of special procedures and sequences (format by CxP and content by contractor and design team).
 - For 24-hour facilities or those with critical processes, provide maintenance start-up and shutdown, manual, and restart operation procedures for equipment and systems controlled by the building automation system and by stand-alone equipment controllers (by CxP).
 - Special useful notes and instructions to operators not found in the O&M Manuals or control sequences that emerged from the commissioning process (by CxP).
 - Training materials from the original trainings if different than the O&M manuals and any video recordings of trainings (by contractor).
- (3) Performance Persistence and Optimization Program
 - Recommendations for recalibration frequency of sensors and actuators by type and use (by CxP).
 - Plan outline for monitored based Ongoing Commissioning or recommended frequency for periodic recommissioning testing by equipment type with reference to construction-completed tests and checklists, including blank forms (by CxP).

- Description of the primary recommended standard trend logs in the control system and control system reports that will assist in maintaining comfort, energy efficiency, and system control, including report templates and sample plots with explanations of what to look for in the graphs. These trends may include air handler functions (economizer, duct static pressure reset, supply air temp reset); boiler functions (HWST, HW pump control); chiller functions (CHWST, CWST, pump control), etc. (by CxP).
 - Description and use instructions for any installed fault detection features (by CxP).
 - Description and use of the energy management system and energy information system reports, when installed (by CxP).
 - Guidelines for establishing performance metrics and benchmarks and guidelines for tracking whole-building and primary end-use energy and efficiency (by CxP).
 - Suggestions for changes in the way things are controlled, set points, and sequence strategies for optimizing energy efficiency, comfort, and control coming out of the commissioning process to date (by CxP).
- (4) Commissioning Record (all by CxP)
- Summary commissioning report.
 - Issues log.
 - Issue resolution plan.
 - Lessons learned.
 - Cx Plan.
 - Cx Specifications.
 - Design, OPR and BOD review record.
 - Submittal reviews, including of TAB & O&Ms.
 - Testing schedule, progress reports and field observations.
 - Training record.
 - Completed and blank construction checklists and start-up reports.
 - Completed and blank functional tests and trend logs.
 - 10-month operations review and seasonal testing record.
 - 12-month energy usage intensity (EUI) report
- (5) Maintenance Procedures (all by contractor)
- O&M manuals.
 - Preventive maintenance procedures for all commissioned equipment. This shall be a link directly into the appropriate page of the respective O&M manual, but if no maintenance procedures are given in the O&Ms a list of procedures will need to be created. (O&Ms with links in pdf's made by contractor).
 - Warranties.
- (6) Construction Record (all by contractor)

- Record drawings.
 - Specifications.
 - Approved submittals.
 - Approved change orders.
- (7) Final air and water balance report
- (8) If requested, submit required documentation to USGBC for LEED certification for the Cx credits.
- (9) Conduct seasonal testing at near peak heating and cooling conditions, primarily by trending when possible. Also confirm space temperature control performance in all rooms, general building pressure and any special room differential pressure control. Submit report to Campus.
- (10) Conduct an on-site Building Operations Review about 10 months after project completion. Review work orders related to commissioned systems, review of alarm and complaint logs and review of selected trend logs of known problem areas and other critical areas to confirm proper performance and equipment operation. Document issues and proposed solutions and identify responsible parties. Submit a report of the Review to Campus. Update the Cx Report.
- (11) Document monthly EUI metrics after occupancy using the template in Exhibit B. Submit report to campus and CPDC.

Systems and Assemblies to be Commissioned

CxP shall work with campus to determine the applicable systems to be commissioned.

HVAC Systems and Equipment Controls

- Chilled water system (chiller, cooling tower, piping, pumps)
- Heating water system (boilers, piping, pumps)
- Under floor air distribution system
- Air handlers (including minimum outside air control,
- CO2 monitoring, heat recovery, humidification)
- Hydronic piping (including air separators and expansion tanks)
- Ductwork
- Thermal comfort, temperature and humidity control
- Variable speed drives
- Outside air valves
- Perimeter heaters
- Unit heaters
- Air terminal boxes
- Variable refrigerant flow (VRF) system
- Computer room air conditioning units
- Fan coil units
- Restroom exhaust system
- Misc. exhaust fans
- Garage exhaust fans

- Building automation and control system (BAS)
- Data acquisition system
- Atrium smoke control system
- Radiant floor heating
- TAB work
- HVAC and envelope differential pressure relationships

Electrical Systems

If electrical equipment other than lighting controls and emergency generators are to be tested by the CxP rather than the contractor's certified testing company, then additional detail should be provided in scope such as which tests and inspections will be required for each piece of equipment. Refer to InterNational Electrical Testing Association (NETA) testing standards and specifications online.

- Scheduled lighting controls
- Exterior lighting controls
- Daylight dimming controls
- Lighting occupancy sensors
- Wire and cable
- Medium voltage shielded cable
- Wiring devices (switches and outlets)
- Switchgear
- Motor control centers
- Transformers
- Variable frequency drives
- Ground fault
- Secondary grounding
- Low voltage metal-enclosed switchgear
- Bus duct
- Emergency power generator system and ATS
- Whole building power outage integrated test
- Photovoltaics
- Battery Energy Storage Systems

Fire Life Safety

- Fire alarm system
- Fire protection
- Stair pressurization system
- Fire smoke dampers

Plumbing

- Domestic water system (booster pumps)
- Domestic water heating system (heaters, circulation pumps, mixing valves)
- Sump and ejector pumps
- Irrigation systems and controls
- Automatic fixture control
- Grey/rainwater system
- Solar hot water

Laboratory and Clean Room

- General lab exhaust systems
- Lab and room pressurization control

- Air terminal units (supply and exhaust valves)
- Room differential pressure controls and equipment (exhaust and makeup fans and terminals)
- Fume hood functionality (not including ASHRAE 110 tests or other certifications)
- Hood and process exhaust systems
- Exhaust scrubbers
- Biological safety cabinets
- Safety cabinets
- Cold rooms
- Bio-waste sterilization
- Lab vacuum pumps
- Lab air compressor
- Cleanroom fan filter units
- Cleanroom makeup air units
- Cleanroom certification
- Pure water systems
- Process gas systems
- Process coolers

Building Enclosure

If Campus wishes to include Building Enclosure within Cx scope, determine when component inspections by CxP shall happen; pre-installation (including a conference with installers), during installation, or post-installation. CxP will inspect a sufficient fraction of components to be reasonably confident they are being installed properly. Contractor will also fill in construction checklists for each.

- Roofing system – water-proofing, insulation, roof membrane, rain and ice shield, pitch, coping, flashing, curbs for mechanical equipment, downspouts, drains, scuppers.
- Exterior wall opaque sections – curtain wall, storefront, masonry, brick / stone veneers, precast panels, metal panels, stucco, siding, sun shades, expansion joint cover assemblies.
- Walls – vapor barriers, insulation, mortar nets, weeps, joints, sealants, masonry ties, damp proofing, composite sheet waterproofing, flashing.
- Slab and landscaping on grade – slab vapor barriers & waterproofing, drainage slope, foundation drains, crystalline waterproofing.
- Concrete walls of occupied areas below grade: waterproofing, French drains.
- Doors, windows and skylights – sealants, mechanical operation, sills, flashing, end dams, hardware.
- Indicate for which assemblies performance testing will be conducted, and what fraction or quantity of each:
 - Water tests of roofs, slabs, doors, fenestration and/or exterior skin via mockups or in situ tests.
 - Infiltration evaluation via wind or pressure tests of doors, fenestration and/or exterior opaque wall sections via mockups, wind tunnel or in situ tests.
 - Building-wide air leakage via pressurization tests.
 - Thermography tests of fenestration and door perimeters, exterior opaque wall sections and joints and/or roofing.
 - Structural wind loading tests of exterior skin mockups or other elements.
 - Potential special roof conditions - green roof; roof terrace/roof garden.

Special Systems

Projection screens

- Automatic window shades
- Elevators
- Electric coiling doors and grills
- Loading dock lift

LEED features to meet desired level of certification through:

- Energy and Atmosphere Cx credits
- M&V Credits

- Environmental Quality credits
- Water Efficiency credits
- Living Building Challenge features to meet desired petals:
 - Place petal
 - Water petal
 - Energy petal
 - Health + Happiness petal
 - Materials petal
 - Equity petal
 - Beauty petal

Service Duration

The term of the service authorization shall begin at Schematic Design and conclude at the end of the Post-Occupancy phase.

Fee

- a) Commissioning fee for each project shall be provided on an hourly rate in accordance with the Billing Rate Table agreed and attached hereto as Exhibit C with a maximum 'not to exceed' amount identified, as calculated by Attachment 1 to Exhibit C. Invoicing for services shall be provided monthly.
- b) The work effort shall generally align to the percentage ranges below. Advise the Trustees at the earliest opportunity if it is anticipated that the required effort will vary materially from these ranges.

Percentage of fee	Milestone
25%	Completion of Schematic Phase
20%	Completion of Design Development Phase
0%	Bidding
20%	50% construction completion
25%	100% construction completion
10%	1-year Post-Occupancy review and report

Deliverables

Provide deliverables as specified in the applicable scope of commissioning work above.

- a) Note that the OPR and Commissioning Plan should be part of Campus submittal to CPDC at 75% Schematic Drawings for all major capital projects, per the Major Capital Project Transmittal Sheet, available via the Resource Library.
- b) At other milestones:
 - i. Provide electronic copies of report to Campus. Deliver via email or FTP, Dropbox, etc.
 - ii. Provide print report copies to campus as requested.

Scope Summary

This scope is modified as follows:

- No modifications
- As listed below:

- a) Attached (suggested, campus to select/provide):
 - i. Summary of deliverables at each stage
 - ii. CSU commissioning guidelines current as of MEA issuance
 - iii. OPR guidelines current as of MEA issuance

All correspondence regarding commissioning shall be sent to **NAME, TITLE**, with a copy to **NAME, TITLE**.

End of Attachment 1

THE CALIFORNIA STATE UNIVERSITY
Attachment – 2 Retrocommissioning (RCx) Scope of Work
Digital Energy, Inc.

The objective of the CSU retrocommissioning process is to provide a systematic approach to test, document, review and make adjustments to bring building systems and components to the original design functionality, or to meet new functional requirements as they may change from original design, using current best practices to provide the intended functionality in the most efficient manner and meet CSU's operational and project requirements.

The Service Provider engaged for this work is hereby designated as the Retrocommissioning Provider (RCxP) for the project. In this role the RCxP acts as a consultant and vendor to the campus to test, document, review and make adjustments to the building systems to accomplish the scope of work. The RCxP serves as the Engineer of Record for this retrocommissioning project.

The RCxP shall perform to the selected scope of work using the most current CSU Commissioning Guidelines (available through the CSU CPDC [Resource Library](#)) as a reference. The RCxP shall seek direction from the campus where guideline or scope requirements relative to the specific project are not applicable.

Retrocommissioning (RCx) Objectives

Retrocommissioning is an important process to restore optimal functionality and efficiency to aged buildings. Over time certain systems or control components of a building can become uncalibrated and adversely affect the occupant comfort and efficiency of a building's operations. RCx pinpoints these problems and seeks to remedy them.

The existing building retrocommissioning scope of work will involve the RCxP through four phases of the project.

1. During the planning phase, the RCxP shall work with the campus project team to define Owner's Project Requirements as well as develop a Retrocommissioning Plan.
2. During the investigation phase, the role of the RCxP is to conduct a systematic analysis of the building(s)' performance through observation, review of building documents and O&M practices, and trending and testing of building systems.
3. During the implementation phase, the RCxP shall develop an Implementation Plan for the measures selected from the investigation phase, implement said measures, and verify that the operational goals were achieved.

4. During the handoff phase, the RCxP shall provide the Final Report and Systems Manual such that the campus building operators have sufficient materials to monitor and maintain the implemented RCx measures.

Scopes of Work

Campus project team shall determine which scope of work is applicable to the project.

1. Phase 1: Planning
 - a) Deliverables
 - i. Retrocommissioning Plan
 - ii. Project kick-off meeting
 - b) Activities
 - i. The RCxP Work with Campus to determine the scope of the project, including the buildings and systems to be included in the project.
 - ii. Determine the objectives of the RCx effort, which may include reducing energy usage, solving indoor air quality problems, and troubleshooting persistent occupant comfort concerns.
 - iii. Interview campus staff and review the existing building documentation to determine the original specifications, design intent, and their relevance to current owner / user requirements
 - iv. Document current operating requirements through review of the buildings use and occupancy, as well as campus and department specific operational requirements.
 - v. Perform initial site walk-through to incorporate site conditions in the RCx planning.
 - vi. Develop retrocommissioning plan for testing and reporting on the pertinent systems, including documentation strategies. The retro-commissioning plan should include the following:
 - (1) Equipment, systems, or specific measures to be included, or selection criteria for inclusion
 - (2) Plan for reviewing existing systems and related documentation
 - (3) Define current operational requirements from original design documents and interviews with agency staff
 - (4) Detailed plan for equipment calibrations, including calibration forms
 - (5) Maintenance checks to be performed
 - (6) Detailed plan for diagnostic monitoring / trending, including data archival
 - (7) Functional tests to be performed
 - (8) Methods to be used in analyzing the monitored / trended data
 - (9) Plan to assess and document the current operating strategies and sequences of operation for all systems and equipment included

- (10) Strategies to be used in calculating energy impacts and implementation cost estimates for opportunities identified
- (11) Implementation schedule
- (12) Define the content of the final retro-commissioning report
- vii. Hold project kick-off meeting with all campus stakeholders. Review the RCx plan and coordinate for execution of the project plan.

2. Phase 2: Investigation

a) Deliverables

- i. Perform simple repairs
- ii. Diagnostic monitoring plan
- iii. Develop master list of findings
- iv. List of improvements

b) Activities

- i. Perform diagnostic monitoring using the trending capability of the control system for troubleshooting, testing, and data gathering (when cost-effective), or install data logger devices as per the RCx plan.
- ii. Calibrate sensors as needed according to the RCx plan:
 - (1) Test equipment used for calibration should have traceable calibration documentation provided in the final report.
 - (2) Document test equipment readings versus the EMCS sensor readings prior to adjustment.
 - (3) Document the adjustments made to match the EMCS sensor readings to the test equipment readings.
 - (4) A minimum of two points of calibration to check both slope and intercept are required for sensors seeing a wide range of conditions such as the outside air temperature sensors. Adjusting the offset may be sufficient for sensors seeing a narrow range of conditions.
 - (5) Document test equipment readings versus the EMCS sensor readings following adjustment (calibration) and note date and time of the adjustments made.
- i. Perform functional testing by changing parameters, set-points or conditions, and observing and documenting the actual system or equipment response through various modes and conditions (both simulated and real). Tests should be developed on a case-by-case basis, and be documented in the RCx plan, to ensure functionality across normal operating conditions. For equipment that is being monitored with sufficient points, manual testing may be accomplished by changing the parameters, etc., during the monitored period. The monitored data is then examined and used to document and verify correct or incorrect operation. Visual verification of equipment functionality may be required if feedback from the control system is not available.
- ii. Perform simple repairs that can be made on site that determined as a result of the functional performance testing.

- iii. Develop master list of findings and actions taken. Calculate energy impacts and develop implementation cost estimates for measures Track resolution of deficiencies and necessary capital repairs.
 - iv. In collaboration with Campus staff, prioritize and select operational improvements for implementation within available budget.
3. Phase 3: Implementation
- a) Deliverables
 - i. Implementation plan
 - ii. Implementation summary report
 - b) Activities
 - i. Develop implementation plan to implement operational improvements and/or capital repairs determined in investigation. Develop resource plan and master schedule and coordinate with Campus through bi-weekly project meetings.
 - ii. Implement selected operational improvements.
 - iii. Verify results. Review trend data or repeat functional tests to ensure system is commissioned and operating as expected. Repeat adjustments or implement additional repairs as needed to resolve issues.
 - iv. Update master list of findings with actions taken and resolutions
4. Phase 4: Handoff
- a) Deliverables
 - i. Final Report
 - ii. New/Updated Systems Manual
 - iii. Recommissioning Plan
 - b) Activities
 - i. Develop final report. The final retro-commissioning report shall be issued once commissioning scoping activities are completed, and include:
 - (1) Executive summary
 - (2) Project background and scope of the commissioning project
 - (3) Overview of activities conducted
 - (4) Details of all potential improvements identified and other findings, including:
 - (5) Documentation of equipment conditions
 - (6) Any needed facility staff training
 - (7) Missing critical documentation
 - (8) The estimated implementation costs and the energy impacts for each improvement
 - (9) Current system operation sequences for all equipment and systems included
 - (10) The retro-commissioning plan (appendix item)

- (11) The EMCS / data logger trended data, analysis, and annotated results. Electronic copies of the data should be provided (appendix item)
 - (12) Completed calibration worksheets (appendix item)
 - (13) Documentation of campus witnessing, as required (appendix item)
- ii. Develop/update Systems Manual. The manual will be one electronic suite of pdf documents, all organized, bookmarked and hyperlinked. Bookmarks must be down to the equipment level for submittals and O&Ms, startup reports, test record, etc. **The Systems Manual is also provided in hard copy to the Campus (one copy provided).** The contents of the Systems Manual generally follow ASHRAE Guideline 0, and include all of the retrocommissioned systems.
- iii. Systems Manual Contents
- (1) Table of Contents (bookmarked and hyperlinked)
 - (2) Executive Summary
 - (3) OPR, System Narratives and system flow diagrams or schematics
 - (4) Operating Requirements
 - Owner approved building occupancy schedule.
 - Equipment run-time schedules.
 - Minimum outside air requirements (general building wide).
 - By space: use, temperature, humidity, lighting level and any special noise, pressure, return air, air change requirements.
 - (5) Operating Parameters and Procedures
 - As-built sequence of operations for all equipment, including those with standalone controllers.
 - As-built control drawings, including points list.
 - A list of all user-adjustable set points and reset schedules, their purpose, and range of reasonable adjustments with energy implications when adjusting them—including the central building automation system and packaged equipment controllers.
 - A description of and rationale for all major energy-saving features and strategies with operating instructions and caveats about their function and maintenance.
 - Fire and emergency power response criteria in matrix format, including narratives of special procedures and sequences.
 - For 24-hour facilities or those with critical processes, provide maintenance start-up and shutdown, manual, and restart operation procedures for equipment and systems controlled by the building automation system and by stand-alone equipment controllers.

- Special useful notes and instructions to operators not found in the O&M Manuals or control sequences that emerged from the retrocommissioning process.
 - Training materials from the original trainings if different than the O&M manuals and any video recordings of trainings.
- (6) Performance Persistence and Optimization Program
- Recommendations for recalibration frequency of sensors and actuators by type and use.
 - Plan outline for monitored based Ongoing Commissioning or recommended frequency for periodic recommissioning testing by equipment type with reference to construction-completed tests and checklists, including blank forms.
 - Description of the primary recommended standard trend logs in the control system and control system reports that will assist in maintaining comfort, energy efficiency, and system control, including report templates and sample plots with explanations of what to look for in the graphs. These trends may include air handler functions (economizer, duct static pressure reset, supply air temp reset); boiler functions (HWST, HW pump control); chiller functions (CHWST, CWST, pump control), etc.
 - Description and use instructions for any installed fault detection features.
 - Description and use of the energy management system and energy information system reports, when installed.
 - Guidelines for establishing performance metrics and benchmarks and guidelines for tracking whole-building and primary end-use energy and efficiency.
 - Suggestions for changes in the way things are controlled, set points, and sequence strategies for optimizing energy efficiency, comfort, and control coming out of the commissioning process to date.
- (7) Commissioning Record (Append RCx Final Report to original Commissioning Record)
- (8) Maintenance Procedures
- O&M manuals.
 - Preventive maintenance procedures for all retrocommissioned equipment. This shall be a link directly into the appropriate page of the respective O&M manual, but if no maintenance procedures are given in the O&Ms a list of procedures will need to be created.
 - Warranties.
- (1) Construction Record (from Cx System Manual, updated/add if any capital measures implemented)
- Record drawings.

- Specifications.
 - Approved submittals.
 - Approved change orders.
 - Final air and water balance report
- iv. Provide training. Conduct 8-hour hands-on training with Campus facilities/physical plant/plant operations/operations & maintenance staff and operators. Review systems retrocommissioned, actions taken, and trends set up for future monitoring. Review systems manual.
- v. Close-out meeting. Conduct final project meeting to review project results, answer final questions and handover final Retrocommissioning Report and Systems Manual.

Systems and Assemblies to be Retrocommissioned

RCxP shall work with campus to determine the applicable systems to be commissioned.

HVAC Systems and Equipment Controls

- Chilled water system (chiller, cooling tower, piping, pumps)
- Heating water system (boilers, piping, pumps)
- Under floor air distribution system
- Air handlers (including minimum outside air control, CO2 monitoring, heat recovery, humidification)
- Hydronic piping (including air separators and expansion tanks)
- Thermal comfort, temperature and humidity control
- Variable speed drives
- Outside air valves
- Perimeter heaters
- Unit heaters
- Air terminal boxes
- Variable refrigerant flow (VRF) system
- Computer room air conditioning units
- Fan coil units
- Restroom exhaust system
- Misc. exhaust fans
- Garage exhaust fans
- Building automation and control system (BAS)
- Data acquisition system
- Atrium smoke control system
- Radiant floor heating
- HVAC and envelope differential pressure relationships

Electrical Systems

- Scheduled lighting controls
- Exterior lighting controls
- Daylight dimming controls
- Lighting occupancy sensors
- Wire and cable
- Medium voltage shielded cable

- Wiring devices (switches and outlets)
- Switchgear
- Motor control centers
- Transformers
- Variable frequency drives
- Ground fault
- Secondary grounding
- Low voltage metal-enclosed switchgear

- Bus duct
- Emergency power generator system and ATS
- Whole building power outage integrated test
- Photovoltaics
- Battery Energy Storage Systems

Fire Life Safety

- Fire alarm system
- Fire protection
- Stair pressurization system
- Fire smoke dampers

Plumbing

- Domestic water system (booster pumps)
- Domestic water heating system (heaters, circulation pumps, mixing valves)
- Sump and ejector pumps
- Irrigation systems and controls
- Automatic fixture control
- Grey/rainwater system
- Solar hot water

Laboratory and Clean Room

- General lab exhaust systems
- Lab and room pressurization control
- Air terminal units (supply and exhaust valves)
- Room differential pressure controls and equipment (exhaust and makeup fans and terminals)
- Fume hood functionality (not including ASHRAE 110 tests or other certifications)
- Hood and process exhaust systems
- Exhaust scrubbers
- Biological safety cabinets
- Cold rooms
- Bio-waste sterilization
- Lab vacuum pumps
- Lab air compressor
- Cleanroom fan filter units
- Cleanroom makeup air units
- Cleanroom certification
- Pure water systems
- Process gas systems
- Process coolers
- Safety cabinets

Special Systems Projection screens

- Automatic window shades
- Elevators
- Electric coiling doors and grills
- Loading dock lift Service Duration

The term of the service authorization shall begin at the planning phase and conclude with the hand-off phase.

Fee

- a) Commissioning fee for each project shall be provided on an hourly rate in accordance with the Billing Rate Table agreed and attached hereto as Exhibit C with a maximum ‘not to exceed’ amount identified, as calculated by Attachment 1 to Exhibit C. Invoicing for services shall be provided monthly.
- b) The work effort shall generally align to the percentage’s ranges below. Advise the trustees at the earliest opportunity if it is anticipated that the required effort will vary materially from these ranges.

Percentage of fee	Phase/Milestone
10%	Planning Phase / Retrocommissioning Plan
40%	Investigation Phase / Lists of Findings and Improvements
40%	Implementation Phase/ Implementation Summary Report
10%	Handoff Phase / Final Report & Close-out Meeting

Deliverables

- a) Provide deliverables as specified in the applicable scope of retrocommissioning work above in the format specified:
- b) Provide electronic copies of reports to Campus. Deliver via email or FTP, Dropbox, etc.
- c) Provide print report copies to campus as requested.

Scope Summary

This scope is modified as follows:

- No modifications
- As listed below:

Attached (campus to determine/provide):

- 1.
- 2.
- 3.

All correspondence regarding commissioning shall be sent to **NAME, TITLE**, with a copy to **NAME, TITLE**.

End of Attachment 2

THE CALIFORNIA STATE UNIVERSITY
Attachment 3 - Monitoring-Based Commissioning (MBCx) Scope of Work
Digital Energy, Inc.

(Sample Only – Campus to update or provide actual scope)

The objective of the CSU Monitoring Based Commissioning process is to utilize permanent data trending from a campus' energy management systems controlling electrical and mechanical systems to detect and diagnose faults within the systems. The MBCx process is also intended to make adjustments to bring building systems and components to bring the original design functionality, or to meet new functional requirements as they may change from original design using current best practices to provide the intended functionality in the most efficient manner and meet CSU's operational and project requirements.. The preferred software is SkySpark® analytics software, although similar software products may be considered if proposed. This includes monitoring of zone level sensor data such as space temperatures, set points, valve positions, airflow, commands, and similar data that can be analyzed to detect faults.

The Service Provider engaged for this work is hereby designated as the Monitoring Based Commissioning Provider (MBCxP) for the project. In this role the MBCxP acts as a consultant and vendor to the campus to test, document, review and make adjustments to the building systems to accomplish the scope of work. The MBCxP serves as the Engineer of Record for this monitoring based commissioning project. The MBCxP shall perform to the selected scope of work using the most current CSU Commissioning Guidelines (available through the CSU CPDC [Resource Library](#)) as a reference.

The MBCxP shall seek direction from the campus where guideline or scope requirements relative to the specific project are not applicable.

Monitoring-Based Commissioning (MBCx) Objectives

The goal of an MBCx process is to maintain existing improvements and implement further improvements to building performance over time. Monitoring-based commissioning is defined as the implementation of an ongoing commissioning process with focus on monitoring and analyzing large amounts of data on a continuous basis.

The existing building MBCx scope of work will involve the MBCxP through three phases of the project.

1. During the planning phase, the MBCxP shall work with the campus project team to establish the technical plan and define the scope of how MBCx will

be implemented using the energy management system (EMS) and/or energy information system (EIS).

2. During the EMS/EIS configuration phase, the role of the MBCxP is to configure and calibrate necessary data points (e.g. fault detection, energy savings), user interfaces, and sensors for the accurate tracking of data over the course of the project.
3. During the implementation phase, the MBCxP shall identify issues and opportunities for corrective action and work with the campus project team to implement these measures, and update facility documentation accordingly, as well as deliver a final report and necessary training.

Scopes of Work

1. Phase 1: Planning
 - a) Deliverables
 - i. Monitoring Action Plan (MAP)
 - ii. Training Plan
 - iii. Kick-off meeting
 - b) Activities
 - i. Hold project kick-off meeting
 - ii. Collect building documentation and create/update current facility requirements. Work with campus and building personnel to identify normal operating ranges for monitored systems. Requirement will be used inform the monitoring action plan. Requirements for the following shall be included as applicable: Indoor temperature and humidity, occupied and unoccupied mode, building operational hours, special use areas, other key operational
 - iii. Define high priority systems for performance monitoring. Work with campus and facility personnel to identify the critical facility systems to be monitored. Focus should be given to previously implemented commissioning efforts and other key energy saving features as defined by the campus. Building systems to be monitored may include the following systems: Chillers and cooling towers, boilers, air handlers, terminal units, packaged HVAC, lighting, commercial refrigeration, whole building meters, energy submeters, others as defined by campus.
 - iv. Create a Monitoring Action Plan. The Monitoring Action Plan (MAP) will serve as the key document for the MBCx project. The MAP should define the metrics, views, and analytics to be used through the project. A template MAP is included as Appendix 1 to this document.
 - v. Specify enhancements for EMIS. During the creation of the MAP, MBCx Agent should identify any necessary or suggested enhancements to the EMIS that will allow for a more successful project.

- vi. Create a training plan. A training plan that identifies areas of necessary training and personnel requiring training should be created using the facilities requirements, priority systems, and MAP as guidelines.
2. Phase 2: EMS and EIS Configuration
 - a) Deliverables
 - i. Calibration Plan
 - ii. EMS/EIS User Guide and Configuration Summary
 - iii. Summary of planned energy savings and anomaly tracking periods
 - b) Activities
 - i. Define data configuration requirements. **Appendix 2 (Data Configuration Requirements, campus specific)** outlines the data types that will be monitored using the EMIS to support the MBCx program. In addition to configuring an ongoing data stream, there will be certain meters for which historical data will also be imported (for example, to provide a historical energy baseline). Data point naming/tagging will follow consistent, transparent naming conventions.
 - ii. Develop calibration plan and calibrate critical sensors. Wherever possible, meters/sensors will be calibrated, and values derived from interval meters and submeters will be cross-checked against monthly billing data or other documents of record to ensure consistency. The most critical points for calibration are: Outside air temperature, air handler supply/return/mixed air temperatures, chilled water supply/return temperatures, hot water supply/return temperatures.
 - iii. Perform EMIS data quality checks. Ensure that data reported to the EMIS meets quality needs for the MBCx project. Issues that should be identified and remedied include data values falling outside the range of an installed meter or sensor, meters installed incorrectly, insufficient data capture (e.g., memory, value, sample rates, or gaps in timeseries errors), data reporting errors, misleading labels, insufficient sampling rates.
 - iv. Create an EMS or EIS user interface. As allowable Cx agent shall design and implement dashboards and drill-down views will be configured for the MBCx program, to support the MAP and other general reporting needs. Cx agent shall work with the campus and facilities personnel to identify requirements and capabilities.
 - v. Configure fault detection diagnostics (FDD).
 - vi. Configure diagnostics, energy savings and anomaly tracking. Savings tracking will be configured using appropriate modeling techniques in accordance with CalTRACK 1.0 (<https://www.caltrack.org/>).

3. Phase 3: Implementation

a) Deliverables

- i. Implementation report
 - ii. Updated facility documentation
 - iii. Building operator training
- b) Activities
- i. Identify issues and opportunities using EMS/EIS and the Monitoring Action Plan. Using the previously crated project deliverables identify issues using either automated methods or manual review and compile into an issues log
 - ii. Investigate root cause for prioritized issues.
 - iii. Identify and implement corrective actions.
 - iv. Verify performance improvement
 - v. Tracking of Improvements/Repairs. All recommendations shall be tracked for progress and each item’s status and history shall be recorded on the Findings Log. Any item that was detected through data analytics shall be verified as completed once noted as such, by review of the relevant data to ensure the issue was resolved.
 - vi. Report Findings – Recommendations shall be presented to the Campus at regular intervals (specify interval) during the duration of the commissioning project, culminating in a final report. The final MBCx report shall include a description of the facility, HVAC equipment, controls, operating schedules, operational deficiencies and energy efficiency opportunities (commonly referred to as a Findings Log), changes in project scope, an analysis of baseline and post-MBCx energy use and the resulting energy savings along with a verbal and visual description of the analysis approach, and any other issues encountered which are relevant to a comprehensive understanding of the project. The Final Report should also describe the staff training program which will be offered and when it will take place.
 - vii. Update Systems Manual. The systems manual will include
 - o MBCx Final Report
 - o Alarm set points
 - o Available monitoring points and active trending capabilities
 - o Control graphics or diagrams
 - o O&M plan
 - o Ongoing diagnostics
 - o M&V Plan
 - o General building or plant info & Design intent (current facility requirements)
 - o System diagram and descriptions
 - o Equipment schedules & control sequences (this includes setpoints)
 - o Available monitoring points and recommended trend groups
 - o ECM persistence recommendations
 - o Updated findings log and action plan
 - o Updated benchmarking and baseline data

- Operator training plans and records
- Plans for Recommissioning to maintain persistence (15 years).
- Summary of available as-built records & documentation
- Conduct 8-hour hands-on training with Campus facilities/physical plant/plant operations/operations & maintenance staff and operators. Review systems commissioned, actions taken, and trends set up for future monitoring.

Systems and Assemblies to be Commissioned

MBCxP shall work with campus to determine the applicable systems to be commissioned.

HVAC Systems and Equipment Controls

- Chilled water system (chiller, cooling tower, piping, pumps)
- Heating water system (boilers, piping, pumps)
- Under floor air distribution system
- Air handlers (including minimum outside air control,
- CO2 monitoring, heat recovery, humidification)
- Hydronic piping (including air separators and expansion tanks)
- Ductwork
- Thermal comfort, temperature and humidity control
- Variable speed drives
- Outside air valves
- Perimeter heaters
- Unit heaters
- Air terminal boxes
- Variable refrigerant flow (VRF) system
- Computer room air conditioning units
- Fan coil units
- Restroom exhaust system
- Misc. exhaust fans
- Garage exhaust fans
- Building automation and control system (BAS)
- Data acquisition system
- Atrium smoke control system
- Radiant floor heating
- TAB work
- HVAC and envelope differential pressure relationships

Electrical Systems

If electrical equipment other than lighting controls and emergency generators are to be tested by the MBCxP rather than the contractor's certified testing company, then additional detail should be provided in scope such as which tests and inspections will be required for each piece of equipment. Refer to InterNational Electrical Testing Association (NETA) testing standards and specifications online.

- Scheduled lighting controls
- Exterior lighting controls

- Daylight dimming controls
- Lighting occupancy sensors
- Wire and cable
- Medium voltage shielded cable
- Wiring devices (switches and outlets)
- Switchgear
- Motor control centers
- Transformers
- Variable frequency drives
- Ground fault
- Secondary grounding
- Low voltage metal-enclosed switchgear
- Bus duct
- Emergency power generator system and ATS
- Whole building power outage integrated test
- Photovoltaics
- Battery Energy Storage Systems

Plumbing

- Domestic water system (booster pumps)
- Domestic water heating system (heaters, circulation pumps, mixing valves)
- Sump and ejector pumps
- Irrigation systems and controls
- Automatic fixture control
- Grey/rainwater system
- Solar hot water

Laboratory and Clean Room

- General lab exhaust systems
- Lab and room pressurization control
- Air terminal units (supply and exhaust valves)
- Room differential pressure controls and equipment (exhaust and makeup fans and terminals)
- Fume hood functionality (not including ASHRAE 110 tests or other certifications)
- Hood and process exhaust systems
- Exhaust scrubbers
- Biological safety cabinets
- Safety cabinets
- Cold rooms
- Bio-waste sterilization
- Lab vacuum pumps
- Lab air compressor
- Cleanroom fan filter units
- Cleanroom makeup air units
- Cleanroom certification
- Pure water systems
- Process gas systems
- Process coolers

Special Systems

- Automatic window shades

Service Duration

The term of the service authorization shall begin at the planning phase and conclude with the hand-off phase.

Fee

Commissioning fee for each project shall be provided on an hourly rate in accordance with the Billing Rate Table agreed and attached hereto as Exhibit C with a maximum ‘not to exceed’ amount identified, as calculated by Attachment 1 to Exhibit C. Invoicing for services shall be provided monthly.

The work effort shall generally align to the percentage’s ranges below. Advise the trustees at the earliest opportunity if it is anticipated that the required effort will vary materially from these ranges.

Percentage of fee	Phase
20%	Planning
40%	EMS/EIS Configuration
40%	Implementation

Deliverables

Provide deliverables as specified in the applicable scope of monitoring based commissioning work above in the format specified:

Provide electronic copies of reports to Campus. Deliver via email or FTP, Dropbox, etc.

Provide print report copies to campus as requested.

Scope Summary

This scope is modified as follows:

- No modifications
- As listed below:

Attached (campus to determine/provide):

1. Monitoring Action Plan (LBNL Template)
2. Data Configuration Requirements (Campus specific)
- 3.

All correspondence regarding commissioning shall be sent to **NAME, TITLE**, with a copy to **NAME, TITLE**.

End of Attachment 3

THE CALIFORNIA STATE UNIVERSITY

**Exhibit "B"- Service Order and Authorization to Proceed,
Digital Energy, Inc.**

[Date]

Mr. John Doe, President
John Doe, LLC
555 Marin Street; Suite 230
Thousand Oaks, CA 91360

Dear Mr. Doe

[Project Name], [Project Number]
[Campus]
Service Order and Authorization to Proceed Number [insert]

In accordance with the provisions of the Systemwide Master Enabling Agreement Number XXXX you are hereby authorized to provide [insert as appropriate].

The Service Provider shall not perform services in excess of this Service Order without prior written authorization to proceed from the University.

Service Provider shall coordinate services with:

[CSU Campus Name]
[Campus Department]
[Executive Dean or Designated Campus Project Manager]
[Campus Address]
[Campus Project Manager's Phone Number]

The total amount to be expended under this Service Order shall not exceed [written and numerical dollar value] inclusive of reimbursables, regardless of Service Provider's cost in performing these services. Service Provider shall submit all invoices with the Agreement and Service Order and Authorization to Proceed number on each invoice to the project manager named above.

Questions regarding this authorization shall be directed to the above-named project manager.

Approved:

Fund Certified:

[Name]
[Department Head]
[Department]

[Name]
[Accounting/Fiscal Officer]
[Department]

cc:

End of Exhibit "B"

THE CALIFORNIA STATE UNIVERSITY
Exhibit “C” – Service Provider Rate Schedule
Digital Energy, Inc.

Discipline	Maximum Rate
Principal (Mechanical, Plumbing, Lighting, PV) (Overall direction and Point of Contact)	\$200.00
Sr. Commissioning Agent – Mechanical & Plumbing	\$165.00
Sr. Commissioning Agent – Mechanical & Plumbing	\$165.00
Jr. Commissioning Agent – Lighting Controls	\$145.00

End of Exhibit “C”

**Exhibit "D" - New Building Energy Usage Intensity Report
 Report of Building First Year Post-Occupancy Energy Consumption
 Digital Energy, Inc.**

Building Name:
 Building Functions:
 Campus:
 Building GSF:
 Commissioning Provider Name:
 Commissioning Provider Company:
 Commissioning Provider Contact Email:
 Campus Contact Name:
 Campus Contact Email:

Description of Building Energy Meters

(Provide a brief description of meters installed, whether they have been installed per manufacturer’s recommendations, and how they were calibrated. Describe if meter readings are automatically or manually read and how the data is compiled)

Building Meter Data

Month-Yr	Electricity (kwh)	Natural Gas (Therms)	Chilled Water (Ton-Hrs)	HHW (or Steam) (Therms)	Energy Usage Intensity (kBTU/SF)
Totals					

End of Exhibit "D"

