Integrated Climate & Energy Strategy (ICES)

Scope of Work

I. Preliminary Project Planning & Data Collection –

1. Participate in regular work sessions with the ICES Project Manager (PM) to;
    a. Clarify scope & deliverables,
    b. Transfer knowledge,
    c. Review all pertinent data and information,
    d. Develop overall project planning process,
    e. Develop deliverable templates,
    f. Identify stakeholders and plan for stakeholder engagement,
    g. Refine campus team roles and responsibilities,
    h. Identify opportunities for maximizing resources & managing budget,
    i. And plan for ICES Technical Team and ICES Project Kickoff Meetings.
    j. Ongoing project management
2. Collect, compile and review existing renewable energy information and data
3. Collect, compile and review existing ARB Scope 1, TCR scopes 1 & 2, and scope 3 (commuters, campus air travel, waste) historical emissions data for 1990, 2000, and 2006-2014
4. Gather pertinent data and information from UCOP and UCSC to be used in the development of scenarios, including but not limited to; allowance and offset markets through 2025, anticipated transitional assistance and other implications beyond 2020, utility forecasting data generated by UCOP for direct access planning, campus forecasting for natural gas purchases through DGS, emissions factors for the Fackler Cogeneration Unit, etc.
5. Review all spreadsheets, documents, plans, data and other resources provided by PM including;
    a. 2008 Strategic Energy Plan, Campus Electrical Master Plan, 10-year Capital Improvements Plan, Yearly Capital Plan, Master Capital Projects spreadsheet, Large Integrated Audits, Building History database, 2011 Climate Action Plan, completed & proposed Higher Education Partnership Project Lists, Campus Sustainability Plan, 2015 Blueprint for Sustainability, cap & trade task force records, Program Planning Guides for all proposed development, ICES notes, and other documents as necessary.
6. Confirm and define the data hierarchy and identify gaps in reliability of information
7. Identify data gaps & assign data collection tasks to pertinent staff, with assistance from PM
8. Review and become familiar with campus energy and facilities management systems
    a. Acquire access to Facilities Link, Tridium Niagara AX building management system, EnergyCAP, Skyspark data analytics, and other pertinent systems, and receive adequate level of training for each
9. Build a database/templates on the campus-provided .ftp site that will serve as the primary data/information repository throughout the ICES process
10. Collaborate with UCSC staff to begin collection of building-level data in energy & facilities management systems and/or manually

a. Assist UCSC staff in the calculation of EUI for buildings over 10,000 SF

11. Review and confirm the delivery format and content of report for carbon reduction measures (CRMs)
12. Draft preliminary project outcome indicators
13. In collaboration with PM, plan and conduct an ICES Technical Team Kickoff Meeting and (broader stakeholder) Project Kickoff Meeting
14. Develop draft outline for ICES Final Report, include outline summary of existing data, information, and metrics

II. Cap & Trade Strategy – Consultant will help UCSC develop a long-term strategy for identifying the most cost-effective, impactful approach[1] to addressing Cap & Trade regulations by completing the following tasks:

1. Using best available data regarding current and future market conditions for Cap & Trade, generate assumptions for regulatory impacts to the campus and incorporate into scenario development and analyses
2. As part of the overarching energy efficiency study, conduct a focused therm savings feasibility study that specifically identifies and analyzes potential CRMs that will reduce onsite scope 1 emissions
    a. Prioritize measures based on life cycle cost and recommend a set of measures that, if implemented, would reduce scope 1 emissions to below the threshold for regulation, including consideration of a buffer for anticipated development
3. Conduct in-depth analysis, described below under "**Data Compilation and Scenario Analysis"**, to compare the life cycle costs and emissions impacts of implementing various mitigation measures, including but not limited to; CRMs, compliance instruments, biogas, natural gas, etc.
4. Develop short and long-term scenarios (2020 to 2025) for consideration in UCSC's strategy for addressing Cap & Trade regulation

III. Energy Efficiency[2] **-** The Consultant will generate a Strategic Energy Plan; identifying the next round of the PG&E Partnership-qualifying projects for 2016 – 2020 and, identifying additional Carbon Reduction Measures (CRMs) sufficient to achieve carbon neutrality by 2025, by completing the following tasks.

1. In collaboration with UCSC Energy & Utility Management staff, develop list of candidate buildings for energy audits in at least 50 buildings;
    a. Generate EUI for each building using existing data,
    b. Rank list of priority buildings into sub-set list of low to high priority,
    c. Collect, compile and/or generate existing building energy use data, such as energy use by fuel type, SF, building use type, outside air temp, utility billing data, etc. for all buildings identified as priority,
    d. Analyze data to identify priority level- high, medium, low.

[1] Scenario Analysis further outlined on page 11.

[2] An overview of the energy systems, infrastructure, operations and energy efficiency background is included in Appendix 2, Energy Background.

i. Generate graphs to illustrate analysis (i.e. EUI, scatter-plot and regression of each utility fuel vs. OSA temperature, etc.)

2. For each priority building, compile and prioritize list of potential CRMs that have already been identified
3. Conduct Energy Efficiency Study to identify additional CRMs (beyond those identified by staff) by executing the following tasks:
    a. Collaborate with pertinent staff to develop Energy Efficiency Audit Process
    b. Conduct desktop audit and/or Preliminary Energy Audit for prioritized buildings on UCSC campus (including 2300 Delaware and selected buildings at the Marine Science Campus)
    c. Identify appropriate level of further audit/study for each prioritized building (ASHRAE Level 1, 2, 3 and Deep Energy Efficiency[3], or customized)
    d. Identify EEMs, ECMs, load management opportunities, improvements to existing energy & building management systems, deferred maintenance projects, and other opportunities, such as;
        i. Evaluate the potential for thermal storage, chilled water optimization, variable flow on cooling towers, virtual chillers, etc.
        ii. Analyze utility demand charges and explore potential demand load-shifting to shave peak demand
        iii. Recommend technology solutions designed to streamline ongoing data collection and analysis, support measurement and verification, and recommend tools and resources to evaluate and assess facility performance in an effective and streamlined fashion
        iv. Identify opportunities for optimizing operating strategies
        v. Analyze equipment life and major components, predicting when they will need to be replaced in the future and considering this in making (phased) recommendations
        vi. Identify monitoring-based commissioning (MBCx) Projects
        vii. Estimate each project's installed costs with assistance from UCSC staff and by obtaining contractor quotes for larger projects
4. Calculate Project Life Cycle Cost including metrics such as: Peak Savings (kW), Electricity Savings (kWh), Gas Savings (therms), Steam/Chilled Water Savings, Annual Cost Savings, net CO2e Savings, CRM project cost (broken down into materials and labor costs), Potential PG&E Incentive (based on campus' Higher Education Partnership incentive rates, w/ PG&E Measure Code Name, Measure Code Number), Estimated Usable Life of hardware, Net Measure Cost, NPV, Simple Payback (yr), MIRR
5. ~~For major energy efficiency projects, conduct a sensitivity analysis and provide a preliminary level design and obtain contractor bids to ensure the project metrics and projected savings~~
6. Recommend financing options and funding mechanisms that consider UCSC's available funding mechanisms and economic constraints
7. Collaborate with Energy & Utility Management staff to identify all potential CRMs that will qualify for the Higher Education Partnership incentive

[3] As will be defined by the Deep Energy Efficiency Study that is currently being conducted by UCOP.

a. Create submittal-ready template consistent with the PG&E "Customized Retrofit Application and Calculation Submittal Guidelines"
b. Provide qualifying CRMs using this template and include an itemized list of project information, metrics and deliverables to expedite the incentive application process

IV. Renewable Energy: The Consultant will evaluate, recommend and facilitate the advancement of renewable energy opportunities at the UCSC Main Campus, 2300 Delaware Ave, the Marine Science Campus in Santa Cruz, CA and the MBEST property in Monterey Bay in support of; 1) The UC Sustainable Practices Policy goal for each UC campus to install 2MW of onsite renewables, and 2) The campus' carbon neutrality goals.

1. In collaboration with the ICES technical team, develop a renewable energy study & implementation process and plan that will adequately outline the best pathway to 2MW renewable energy development on UCSC-owned property
    a. Consider the overall cost-effectiveness of renewables versus other CRMs and weigh options that balance a cost-effective strategy with the goals of carbon neutrality and the UC Sustainable Practices Policy
    b. Determine needs for the following feasibility study steps and implement where appropriate: Site Analysis, Preliminary Design, Production/Financial/Tariff Modeling, Sensitivity & Risk Analysis, Investment Grade Reports, Program Design
    c. Determine needs for the following financing steps and implement where appropriate: Funding & Incentives, Financial Analysis, Due Diligence, Incentives, Management, Fair Market Value Assessment, Renewable Energy Credits (RECs) & Carbon Credit Management
    d. Determine needs for the following project management steps and implement where appropriate: Competitive Procurement (RFPs), Contract Negotiation, Design Review, Permitting and Interconnection, Construction Support, Third Party Commissioning
2. Conduct due diligence
    a. Begin with high-level assessment to evaluate potential sites and sources, prioritizing those that have already been identified by the Campus Electrical Engineer and Campus Energy Manager,
    b. Conduct summary analysis of primary 21KV electric service reliability and power quality, using 2008 Master Electrical Plan as primary reference
    c. Identify necessary modifications and/or infrastructure upgrades to existing systems to support installation of renewables
3. ~~Evaluate implications of existing interconnection agreement with PGE in onsite renewables development and determine strategy for making necessary changes to interconnection agreement where necessary~~
    a. ~~Note: According to the Campus Electrical Engineer, it may be difficult to add any on-site power generation to the existing grid without changing the existing net-import interconnection agreement.~~
    b. ~~If there is a need to re-negotiate interconnection agreement, facilitate this process and, where needed, identify additional expertise to support negotiations~~
4. Conduct financial analysis for each priority project identified

a. Conduct a sensitivity analysis for each CRM
b. Develop detailed financial analysis and carbon implications of proposed projects
    i. Budgets, financial options and funding mechanisms must account for all necessary infrastructure upgrades

5. Recommend financing options and funding mechanisms that consider UCSC's available funding mechanisms and economic constraints
6. ~~Where appropriate, assist staff in developing a comprehensive Request for Proposals for a Power Purchase Agreement for any solar projects identified~~

V. Scenario Analysis to Support Strategic Decision-Making- Achieving UCSC's carbon neutral goal will require a considerable financial investment in a phased, integrated package of CRMs. There are many different technology options and the campus would like to save time and money by evaluating different scenarios, modeling how different technologies work together, incorporating constraints, prioritizing options, and identifying the most cost-effective path to meeting UC's energy and climate goals.

Data Collection & Compilation:

As a preliminary step to building the techno-economic tool, the Consultant will:

1. Organize existing data and collect and compile new data where necessary for:
    a. Total, per capita and per OGSF contiguous campus Scope 1 ARB, Scope 1 & 2 TCR, and Scope 3 TCR, historical, current and projected emissions (1990, 2000, 2006-2025)
    b. Energy use and utility cost by building, by type of building: state-funded v. auxiliary, and residential, dining, classroom, lab, office, etc., and by campus area
    c. 2014-2025 projected energy use and emissions for total campus; cogen & non-cogen, and for state-funded and non-state funded entities (housing/dining, classrooms, office, labs)
    d. Electric and gas utility service description and applicable tariffs
2. Create integrated graphs showing:
    a. Scope 1 2020 & 2025 ARB target, Scope 1 & 2- 2014, 2020, 2025 targets, Scope 3 2050 target, business-as-usual emissions for Scope 1, 2 & 3, and adjusted emissions projections based on various scenarios identified for meeting carbon and energy goals
    a. Pie chart showing all sources of energy use by type and pie chart showing all sources of emissions by type, including on site generation and procured
3. Estimate future campus emissions and energy use based on enrollment, development and other considerations found in the master utility plan, yearly capital financial plan, 10-year Capital Financial Plan and through conducting informational interviews with pertinent stakeholders
4. Develop spreadsheets and generate graphical representations for all data referenced above in formats that can be easily understood by multiple stakeholder groups and absolute reference all raw data
5. Reference sources for all compiled data

Develop Techno-Economic Analysis Tool:

1. Collaborate with the PM and other UC stakeholders to conceptualize a techno-economic analysis tool and the supporting software and web platforms.
2. Using the UCOP carbon calculator tool currently being developed as a template, develop an excel-based, non-proprietary, strategic decision-making tool- with a user-friendly and graphics-based user interface that allows for modification of relevant inputs as conditions evolve- to guide the campus in development of a detailed roadmap for implementation
    a. Tool and graphical interface must be non-proprietary, excel-based with absolutely referenced data, and, if using existing software support that software must be available for purchase at a reasonable price by any UC campus (such as a software package that is available on the market today, such as Microsfot Excel, Crystal Dashboard Design, etc.
    b. The tool must be available to share with other campuses so they can edit as necessary and use for their internal purposes.
    c. Ensure campus-level data can be easily populated into the system level tool
3. Apply a graphical user interface to the tool, such as Crystal Dashboard Design or equivalent, to easily communicate complex data sets

Develop Scenarios to Support Decision-Making Process –

1. Provide a baseline energy and emissions condition and project forward the potential cost and consumption outcomes under a "business as usual" approach.
2. Generate at least three high-level scenarios at the start of the planning process, prior to identification of detailed CRMs, to drive overall goals for each sub-area: energy efficiency/conservation, renewables, procurement, policy/operational changes.
3. Develop a long-term strategy for identifying the most cost-effective, impactful set of strategies for meeting our climate action goals by identifying the mix of supply and demand projects identified during the ICES study that best align with the strategic goals that are integrated into the Strategic Energy Plan
    a. Generate what-if scenarios or sensitivities to be explored (e.g., varying future loads, E2 project bundles, RE costs, utility costs, and/or availability of incentives)
        i. Define analysis goals and constraints (e.g., limits on technology types and sizes, utility market projections, utility interconnection limits, energy export limits, operating risks, overall climate goals)
        ii. Incorporate inputs such as potential CRMs, such as energy efficiency and onsite renewable projects, planned maintenance, behavior change, policy updates, procurement strategies, cap & trade-related factors, biogas, RECs, carbon offsets, compliance instruments, utility costs, project costs, financing costs, and other pertinent inputs
        iii. Incorporate potential large scale changes in the energy markets such as changes to regulations and governmental policy (e.g., fracking, renewable energy, GHG restrictions, and LNG exports)

as well as supply and demand fundamentals affecting underlying wholesale market prices in both regulated and deregulated markets

iv. Confirm the emissions factors for current purchased utility mix and project estimated emissions factors based on information from ESP

v. Energy procurement options, including consideration of system wide wholesale procurement projections as it impacts UCSC (a Direct Access Customer)

b. Develop 4-6 climate scenarios & analyze life cycle assessment and life cycle cost based on pertinent inputs

i. Prioritize projects based on payback (including consideration of the cost of scope 1 emissions)

ii. Evaluate supply side impacts from potential supply projects including fixed pricing protocols (risk management), renewable power purchases, demand response, optimization, and tariff changes

1. Analyze the modification to the baseline condition resulting from the implementation of the supply projects

iii. Evaluate demand side impacts from potential demand projects including generic inputs for capital projects to reduce energy and related utilities (e.g., steam, chilled water, heat, and compressed air)

1. Analyze the modification to the baseline condition resulting from the implementation of demand projects

c. Evaluate procurement options to help offset the campus' carbon footprint

iv. Procurement strategies for renewable energy credits and carbon offsets should be limited to less than 20% of the total strategy for achieving carbon neutrality

4. Provide training to UC staff, faculty and students on use of the scenario analysis tool

VI. General Project Support & Implementation -

1. Provide overall project management to ensure that scope, schedule and budget goals are being met
2. Consultant PM will participate in weekly check-ins with UCSC PM to discuss project updates, identify data gaps, develop strategies to support project goals, develop and assign tasks, and ensure scope, schedule and budget goals are being met, trouble-shoot where necessary
3. Consultant Technical Team will participate in regular meetings with UCSC PM and UCSC Technical Team to support scope, schedule and budget goals
    a. Meeting frequency will be determined by the Consultant PM and UCSC PM and may change throughout the project timeline
4. Conduct quarterly check-ins between Principal and ICES PM to provide opportunity to discuss overall project progress and consultant/client satisfaction with the process
5. Rank all identified CRM projects in terms of their life-cycle costs, prioritize projects, and develop a plan for phased implementation of the most attainable bundles of projects to meet UCSC's climate and energy goals.
    a. As part of the phased plan, align the energy project completion with the Higher Education Partnership financing timeline and with other capital projects to achieve efficiencies, and with making replacement

decisions by accounting for the needs of an entire building and age-related timing, rather than just energy paybacks

6. Assist the campus with the identification of organizational challenges to project implementation, initiatives and/or policy changes, and help the ICES Team strategize solutions
    a. In cooperation with campus units, explore and advise on innovative project delivery mechanisms to efficiently and expediently accomplish bundled CRM projects
    b. Recommend innovative, entrepreneurial funding mechanisms and subsidies, such as rebates and incentives
    c. Recommend strategies for the creation of a revolving pool of funds or other financing mechanisms to support capital projects
7. Where significant gaps and inconsistencies in the utility meter raw data and energy database are discovered, evaluate opportunities and recommend solutions for addressing these issues
8. Explore opportunities for investment in regional project development where a partnership would be mutually beneficial for community stakeholders and the campus
9. In support of the campus' carbon neutrality goals and anticipated "net zero" building design requirements, provide input to staff on the development of a turnkey methodology and tool calculating life cycle costs for all future development
10. Coordinate with pertinent staff and co-present final ICES to campus leadership

VII. Faculty/Student Involvement - UCSC intends to utilize faculty expertise and integrate student involvement in this process as part of a broader commitment to supporting a sustainable "Living Lab" on campus and expects the Consultant to actively embrace this objective. Below are some identified pathways for achieving this objective. Other ideas are welcomed.

To reach carbon neutrality, UC will need to implement aggressive energy efficiency measures in its buildings. Identifying these measures will require a campus-wide energy audit of hundreds of buildings. To keep the audit costs low and to help build an energy efficiency workforce, campus staff will conduct training for interested students, staff and faculty and then enlist trainee assistance in conducting onsite audits. To support this work, the Consultant will:

1. Provide energy auditor training tools and resources to staff and guidance on the structure of the workshop to support the auditing needs of the Consultant team
2. Co-plan and Co-deliver the workshop
    a. The course will teach participants how to identify and evaluate carbon reduction measures, and will include training on assessment tools that facilitate faster and more accurate audits and information on emerging technologies for achieving aggressive energy goals

Throughout the ICES process, campus would like to support student experiential learning opportunities for those already involved in a climate and/or energy-related field of study, course work or on-campus organization. In collaboration with staff, the Consultant will:

1. Identify engagement strategies to provide opportunities for students to support the work of ICES
    a. Potential strategies could include; allowing students to shadow energy audits, assigning them tasks and research requirements to support ICES work and projects, and- for students that participate in the energy auditing workshop- assigning them audit support tasks

Overall Assumptions

The Consultant is expected to:

1. Develop an exceptional, attainable action plan with the potential to serve as a model for universities and colleges, and to collaborate with the campus in developing a model experiential learning component for students;
2. Obtain PM approval for all decisions and changes to strategy that impact the scope of work
3. Copy the PM on all electronic communications concerning the ICES project
4. Maintain a central communication log that documents all conversations between consultant team and any UCSC employees, accessible to the PM via shared workspace such as google docs, etc.
5. Understand and incorporate the climate and energy work that has already been completed by adding value to and complementing existing efforts, recommendations, and data that already exist, without redundancy;
6. Proactively minimize project costs to maximize resource allocation;
7. Identify innovative policies, projects and initiatives that will assist the University in achieving its climate goals;
8. Provide the level of due diligence, feasibility planning and pre-design required to ensure the recommended projects that result from ICES are attainable given the administrative, regulatory and financial requirements of the UC system and the campus context;
9. Prioritize the selection and/or recommendation of non-proprietary products (software and hardware) that are compatible with, complement and/or fully integrate with existing campus systems; products and programs (e.g. Xcelsius for scenario analysis, Tridium AX for BMS)
10. Support the full depth and breadth of the University's sustainability, climate and energy goals, objectives, and aspirations, in particular, UCSC's unique situation related to pending Cap & Trade regulation and how the timeline for decision-making and various ICES strategies will impact the planning and modeling efforts;
11. Identify strategies for streamlining data collection, data reporting & other pertinent processes;
12. Integrate faculty and students into processes, as appropriate, to support experiential learning;
13. To encourage broad support and engagement in climate action, support the campus' integration of an entity or mechanism with ICES that provides an opportunity to implement crowdsourcing, and then crowd-funding and/or crowd-investing, for a portion of the installed photovoltaics
14. Communicate complex data clearly by marrying data with simple visual representation that combines quantitative information with technology and graphic design;
15. Provide leadership and learning opportunities; and
16. Support the sharing of all data, resources and tools generated from this process with other UC campuses.