

**Exhibit A  
SCOPE OF WORK**

**TECHNICAL TASK LIST**

<b>Task #</b>	<b>CPR</b>	<b>Task Name</b>
1	N/A	Administration
2		Technology Assessment
3		Integration of Process Energy Balances
4		Development of a Computer Code and Interface
5		Field Testing of Code Through Plant Audits
6	N/A	Technology Transfer Activities

**KEY NAME LIST**

<b>Task #</b>	<b>Key Personnel</b>	<b>Key Subcontractor(s)</b>	<b>Key Partner(s)</b>
1	Diego Rosso Michael K. Stenstrom Lory Larson	Southern California Edison	--
2	Diego Rosso Michael K. Stenstrom		--
3	Diego Rosso Michael K. Stenstrom		--
4	Diego Rosso Michael K. Stenstrom		--
5	Diego Rosso Michael K. Stenstrom		--
6	Diego Rosso Lory Larson	Southern California Edison	--

**GLOSSARY**

*Specific terms and acronyms used throughout this work statement are defined as follows:*

<b>Acronym</b>	<b>Definition</b>
CPR	Critical Project Review
Energy Commission	California Energy Commission
kWh	Kilowatt Hour
PAC	Project Advisory Committee
PIER	Public Interest Energy Research

<b>Acronym</b>	<b>Definition</b>
SRT	Sludge Retention Time
UCC.1	Uniform Commercial Code (Financing Statement)

### **Problem Statement**

Wastewater treatment consumes significant energy, and a typical secondary treatment plant may require up to 2,500 Kilowatt Hour (kWh)/million gallons of wastewater treated. Costs associated with professional plant energy audits run as high as tens of thousands of dollars and require a team with special knowledge and experience. A previous Public Interest Energy Research (PIER) contract with Southern California Edison (#500-08-008) began development of user-friendly benchmarking software for energy audits of unit operations for wastewater treatment. The previous PIER work developed the benchmarking software for the liquid side of the treatment facility (Phase 1). To complete the prototype auditing tool, benchmarking software must be developed for the solids processing units, including sludge digestion, dewatering and disposal. The ability to self-benchmark the energy usage for all unit operations involved in both the liquid and solids treatment of wastewater will enable plant managers and operators to quantify the energy footprint of their current operations and the increase in energy usage due to declining equipment performance. This is a key component of life-cycle analyses and long-term planning.

### **Goals of the Agreement**

The goal of this Agreement is to complete the development of user-friendly software to allow the auditing of existing plant operation, evaluation of electrical energy saving measures, and conducting of life-cycle analyses.

### **Objectives of the Agreement**

The objectives of this Agreement are to complete the development of software to:

1. Enable users to compare actual energy use with site specific calculations.
2. Identify ways to improve energy efficiency.
3. Calculate potential energy savings based on specific performance data.
4. Quantify the potential energy savings (in kWh/yr) in California due to the quantification of energy usage with this software, and to the subsequent adoption of strategies for energy efficiency.

## **TASK 1.0 ADMINISTRATION**

### **MEETINGS**

#### **Task 1.1 Attend Kick-off Meeting**

The goal of this task is to establish the lines of communication and procedures for implementing this Agreement.

## **The Contractor shall:**

- Attend a “kick-off” meeting with the Commission Contract Manager, the Contracts Officer, and a representative of the Accounting Office. The Contractor shall bring their Project Manager, Contracts Administrator, Accounting Officer, and others designated by the Commission Contract Manager to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the Commission Contract Manager will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Terms and conditions of the Agreement
- CPRs (Task 1.2)
- Match fund documentation (Task 1.7)
- Permit documentation (Task 1.8)

The technical portion of the meeting shall include, but not be limited to, the following:

- The Commission Contract Manager’s expectations for accomplishing tasks described in the Scope of Work;
- An updated Schedule of Deliverables
- Progress Reports (Task 1.4)
- Technical Deliverables (Task 1.5)
- Final Report (Task 1.6)

The Commission Contract Manager shall designate the date and location of this meeting.

## **Contractor Deliverables:**

- An Updated Schedule of Deliverables
- An Updated List of Match Funds
- An Updated List of Permits

## **Commission Contract Manager Deliverables:**

- Final Report Instructions

## **Task 1.2 CPR Meetings**

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and if it should, are there any modifications that need to be made to the tasks, deliverables, schedule or budget.

CPRs provide the opportunity for frank discussions between the Energy Commission and the Contractor. CPRs generally take place at key, predetermined points in the Agreement, as determined by the Commission Contract Manager and as shown in the Technical Task List above and in the Schedule of Deliverables. However, the Commission Contract Manager may schedule additional CPRs as necessary, and, if

necessary, the budget will be reallocated to cover the additional costs borne by the Contractor, but the overall contract amount will not increase.

Participants include the Commission Contract Manager and the Contractor, and may include the Commission Contracts Officer, the PIER Program Team Lead, other Energy Commission staff and Management as well as other individuals selected by the Commission Contract Manager to provide support to the Energy Commission.

**The Commission Contract Manager shall:**

- Determine the location, date and time of each CPR meeting with the Contractor. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send the Contractor the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if continuing, whether or not to modify the tasks, schedule, deliverables and budget for the remainder of the Agreement, including not proceeding with one or more tasks. If the Commission Contract Manager concludes that the project needs a formal amendment or that satisfactory progress is not being made and the project needs to be ended, these conclusions will be referred to the Commission's Research, Development and Demonstration Policy Committee for its concurrence.
- Provide the Contractor with a written determination in accordance with the schedule. The written response may include a requirement for the Contractor to revise one or more deliverable(s) that were included in the CPR.

**The Contractor shall:**

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work of the projects. This report shall be submitted along with any other deliverables identified in this Scope of Work. Submit these documents to the Commission Contract Manager and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

**Contractor Deliverables:**

- CPR Report(s)
- CPR deliverables identified in the Scope of Work

**Commission Contract Manager Deliverables:**

- Agenda and a List of Expected Participants
- Schedule for Written Determination
- Written Determination

**Task 1.3 Final Meeting**

The goal of this task is to closeout this Agreement.

**The Contractor shall:**

- Meet with the Energy Commission to present the findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

This meeting will be attended by, at a minimum, the Contractor, the Commission Contracts Officer, and the Commission Contract Manager. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the Commission Contract Manager.

The technical portion of the meeting shall present findings, conclusions, and recommended next steps (if any) for the Agreement. The Commission Contract Manager will determine the appropriate meeting participants.

The administrative portion of the meeting shall be a discussion with the Commission Contract Manager and the Contracts Officer about the following Agreement closeout items:

- What to do with any state-owned equipment (Options)
- Need to file UCC.1 form re: Energy Commission's interest in patented technology
- Energy Commission's request for specific "generated" data (not already provided in Agreement deliverables)
- Need to document Contractor's disclosure of "subject inventions" developed under the Agreement
- "Surviving" Agreement provisions, such as repayment provisions and confidential deliverables
- Final invoicing and release of retention

- Prepare a schedule for completing the closeout activities for this Agreement.

**Deliverables:**

- Written documentation of meeting agreements and all pertinent information
- Schedule for completing closeout activities

**REPORTING**

**See Exhibit D, Reports/Deliverables/Records.**

**Task 1.4 Quarterly Progress Reports**

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement.

**The Contractor shall:**

- Prepare progress reports which summarize all Agreement activities conducted by the Contractor for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the Commission Contract Manager within 10 working days after the end of the reporting period. Attachment A-2, Progress Report Format, provides the recommended specifications.

**Deliverables:**

- Quarterly Progress Reports

**Task 1.5 Test Plans, Technical Reports and Interim Deliverables**

The goal of this task is to set forth the general requirements for submitting test plans, technical reports and other interim deliverables, unless described differently in the Technical Tasks. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

<http://www.energy.ca.gov/contracts/pier/contractors/index.html>

**The Contractor shall:**

- Unless otherwise directed in this Scope of Work, submit a draft of each deliverable listed in the Technical Tasks to the Commission Contract Manager for review and comment in accordance with the approved Schedule of Deliverables. The Commission Contract Manager will provide written comments back to the Contractor on the draft deliverable within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final deliverable to the Commission Contract Manager. The Commission Contract Manager shall provide

written approval of the final deliverable within 5 working days of receipt. Key elements from this deliverable shall be included in the Final Report for this project.

### **Task 1.6 Final Report**

The goal of this task is to prepare a comprehensive written Final Report that describes the original purpose, approach, results and conclusions of the work done under this Agreement. The Commission Contract Manager will review and approve the Final Report. The Final Report must be completed on or before the termination date of the Agreement. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

<http://www.energy.ca.gov/contracts/pier/contractors/index.html>

The Final Report shall be a public document. If the Contractor has obtained confidential status from the Energy Commission and will be preparing a confidential version of the Final Report as well, the Contractor shall perform the following subtasks for both the public and confidential versions of the Final Report.

#### **Task 1.6.1 Final Report Outline**

##### **The Contractor shall:**

- Prepare a draft outline of the Final Report.
- Submit the draft outline of Final Report to the Commission Contract Manager for review and approval. The Commission Contract Manager will provide written comments back to the Contractor on the draft outline within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final outline to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final outline within 5 working days of receipt.

##### **Deliverables:**

- Draft Outline of the Final Report
- Final Outline of the Final Report

#### **Task 1.6.2 Final Report**

##### **The Contractor shall:**

- Prepare the draft Final Report for this Agreement in accordance with the approved outline.
- Submit the draft Final Report to the Commission Contract Manager for review and comment. The Commission Contract Manager will provide written comments within

10 working days of receipt.

Once agreement on the draft Final Report has been reached, the Commission Contract Manager shall forward the electronic version of this report for Energy Commission internal approval. Once the approval is given, the Commission Contract Manager shall provide written approval to the Contractor within 5 working days.

- Submit one bound copy of the Final Report with the final invoice.

**Deliverables:**

- Draft Final Report
- Final Report

**MATCH FUNDS, PERMITS, AND ELECTRONIC FILE FORMAT**

**Task 1.7 Identify and Obtain Matching Funds**

The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. While the PIER budget for this task will be zero dollars, the Contractor may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds during the term of this Agreement. Match funds must be identified in writing, and the associated commitments obtained before the Contractor can incur any costs for which the Contractor will request reimbursement.

**The Contractor shall:**

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:
  1. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state such in the letter.
  2. If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:
    - A list of the match funds that identifies the:
      - Amount of each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied.
      - Amount of each in-kind contribution, a description, documented market

or book value, and its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Contractor shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.

- A copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured.
- Discuss match funds and the implications to the Agreement if they are significantly reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide the appropriate information to the Commission Contract Manager if during the course of the Agreement additional match funds are received.
- Notify the Commission Contract Manager within 10 working days if during the course of the Agreement existing match funds are reduced. Reduction in match funds may trigger an additional CPR.

**Deliverables:**

- A letter regarding Match Funds or stating that no Match Funds are provided
- Letter(s) for New Match Funds
- A copy of each Match Fund commitment letter
- Letter that Match Funds were Reduced (if applicable)

**Task 1.8 Identify and Obtain Required Permits**

The goal of this task is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track.

Permit costs and the expenses associated with obtaining permits are reimbursable under this Agreement. Permits must be identified in writing before the Contractor can incur any costs related to the use of the permit(s) for which the Contractor will request reimbursement.

**The Contractor shall:**

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:

1. If there are no permits required at the start of this Agreement, then state such in the letter.
2. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
  - A list of the permits that identifies the:
    - Type of permit
    - Name, address and telephone number of the permitting jurisdictions or lead agencies
  - Schedule the Contractor will follow in applying for and obtaining these permits.
- The list of permits and the schedule for obtaining them will be discussed at the kick-off meeting, and a timetable for submitting the updated list, schedule and the copies of the permits will be developed. The implications to the Agreement if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in the progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the appropriate information on each permit and an updated schedule to the Commission Contract Manager.
- As permits are obtained, send a copy of each approved permit to the Commission Contract Manager.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Contract Manager within 5 working days. Either of these events may trigger an additional CPR.

**Deliverables:**

- A letter documenting the Permits or stating that no Permits are required
- Updated list of Permits as they change during the Term of the Agreement
- Updated schedule for acquiring Permits as it changes during the Term of the Agreement
- A copy of each approved Permit

**Task 1.9 Electronic File Format**

The goal of this task is to unify the formats of electronic data and documents provided to the Energy Commission as contract deliverables. Another goal is to establish the computer platforms, operating systems and software that will be required to review and approve all software deliverables.

### **The Contractor shall:**

- Deliver documents to the Commission Contract Manager in the following formats:
  - Data sets shall be in Microsoft (MS) Access or MS Excel file format.
  - PC-based text documents shall be in MS Word file format.
  - Documents intended for public distribution shall be in PDF file format, with the native file format provided as well.
  - Project management documents shall be in MS Project file format.
- Request exemptions to the electronic file format in writing at least 90 days before the deliverable is submitted.

### **Deliverables:**

- A letter requesting exemption from the Electronic File Format (if applicable)

## **TECHNICAL TASKS**

The Contractor shall prepare all deliverables in accordance with the requirements in Task 1.5. Deliverables not requiring a draft version are indicated by marking “(no draft)” after the deliverable name.

### **Task 2 - Technology Assessment**

The goal of this task is to analyze all the unit operations for solids treatment and to quantify the inputs for energy and the important operating parameters (e.g., sludge retention time (SRT) for the digesters) pertinent to these units. The output from this task will be a set of functions that can be implemented in a computer code in a later task. The code will need to be simple enough to run quickly on a personal computer but will be sufficiently broad to capture the relationships among processes. For example, if the SRT is varied, the code will be able to adjust the digester sludge reduction, biosolids production, and biogas production.

### **The Contractor shall:**

- Complete the development of the methodology for collecting site-specific input parameters.
- Develop or select existing mathematical models for unit processes that affect solids handling: thickening, digestion, dewatering, biosolids handling, biogas processing, and energy recovery. These models will not necessarily be the most advanced process models, but instead will be selected to predict accurate power consumption while adequately describing process performance.
- Prepare a Task Report summarizing the input and output parameters and mathematical models for predicting power consumption of site specific unit operations.

**Deliverables:**

- Task Report (no draft)

**Task 3 – Integration of Process Energy Balances**

The goal of this task is to integrate the process energy balances obtained in Task 2 to create an energy balance for the treatment plant. The overall energy balance must be sophisticated enough to transmit effects from upstream processes to downstream processes (e.g., if the primary clarifier efficiency increases, the oxygen demand and sludge production in the following secondary process must decrease).

**The Contractor shall:**

- Finalize the list of troubleshooting tools to determine the cause for a model prediction to be significantly different than actual energy consumption.
- Integrate the process models developed in this phase with those previously developed in Phase I into an overall wastewater treatment plant model that calculates energy use for each treatment process and, in addition, calculates how a change in one treatment process can affect energy use in other processes.
- Develop a methodology for collecting site-specific input parameters such as water quality characteristics and equipment manufacturers' data to facilitate the use of the overall plant model.
- Prepare a Task Report summarizing the integrated energy balance model with troubleshooting tools, and a methodology for collecting site-specific input parameters.

**Deliverables:**

- Task Report (no draft)

**Task 4 – Development of a Computer Code and Interface**

The goal of this task is to take the product of Task 3 and create a computer code to perform the balances with a user-friendly interface. It is expected that most of the work can be continued in Excel with interfaces developed through Visual Basic.

**The Contractor shall:**

- Develop a computer code for all processes and methodologies and develop a user-friendly graphical user interface. To facilitate more widespread use and customization, it is anticipated that the codes can be implemented using a spreadsheet (Excel or equivalent spreadsheet platform using Visual Basic).
- Develop a methodology for calibration of each process model (e.g., specify procedures, bench-scale and full-scale tests that allow calculation of site-specific coefficients of the mathematical models for each process).
- Develop a methodology for comparing existing plant performance with model output.
- Prepare a Task Report to include, but not be limited to the computer code functions and capabilities.

**Deliverables:**

- Task Report (no draft)
- Excel spreadsheet with Visual Basic interfaces using the computer code

**Task 5 – Field Testing of Code Through Plant Audits**

The goal of this task is to compare the modeling results with the code developed in Task 4 to actual plant audits. It is expected that several treatment plants will be needed since no one plant is likely to have the range of different processes of interest.

**The Contractor shall:**

- Develop a list of troubleshooting tools to determine the cause for a model prediction to be significantly different than actual energy consumption.
- Develop a list of energy saving methodologies for each process unit (for digestion, for example, this list may include: digester cleaning, mechanical mixer replacement, improvement of thermal insulation, biogas fugitive emission control, and automatic control).
- Develop a methodology for calculating cost effectiveness of proposed measures considering that each measure will affect not just a process in its application but also other processes (for example, enhanced sludge dewatering decreasing the costs of sludge conveyance to a point of disposal).
- Prepare a Task Report summarizing the methodologies to save energy and cost effectiveness for each process and the troubleshooting tools for accuracy.
- Prepare Sample Plant Audits to evaluate energy use at each facility and how it compares with model prediction.

**Deliverables:**

- Task Report (no draft)
- Sample Plant Audits (no drafts)

**Task 6 - Technology Transfer Activities**

The goal of this task is to develop a plan to make the knowledge gained, experimental results and lessons learned available to key decision-makers.

**The Contractor shall:**

- Prepare a Technology Transfer Plan. The plan shall explain how the knowledge gained in this project will be made available to the public. The level of detail expected is least for research-related projects and highest for demonstration projects. Key elements from this report shall be included in the Final Report for this project.
- Conduct technology transfer activities in accordance with the Technology Transfer Plan. These activities shall be reported in the Quarterly Progress Reports.

**Deliverables:**

- Draft Technology Transfer Plan
- Final Technology Transfer Plan