



GRANT REQUEST FORM (GRF)

A) New Agreement # EPC-19-044 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Robin Goodhand		916-327-1412

C) Recipient's Legal Name	Federal ID Number
T2M Global LLC	82-3035567

D) Title of Project
Ultra-high Efficiency, Lower-Cost, Green Electrolytic H2 for Microgrids in California

E) Term and Amount

Start Date	End Date	Amount
6/30/2020	3/29/2024	\$ 995,250

F) Business Meeting Information

ARFVTP agreements \$75K and under delegated to Executive Director

Proposed Business Meeting Date 6/10/2020 Consent Discussion

Business Meeting Presenter Robin Goodhand Time Needed: 5 minutes

Please select one list serve. EPIC (Electric Program Investment Charge)

Agenda Item Subject and Description:

T2M Global LLC

T2M GLOBAL, LLC. Proposed resolution approving Agreement EPC-19-044 with T2M Global, LLC for a \$995,250 grant to develop and validate an innovative green electrolytic hydrogen storage system for customer side of the meter applications with an electricity-in and electricity-out capability and adopting staff's determination that this action is exempt from CEQA. (EPIC funding) (EPIC funding) Contact: Robin Goodhand.

G) California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?

Yes (skip to question 2)

No (complete the following (PRC 21065 and 14 CCR 15378)):

Explain why Agreement is not considered a "Project":

2. If Agreement is considered a "Project" under CEQA:

a) Agreement **IS** exempt.

Statutory Exemption. List PRC and/or CCR section number:

Categorical Exemption. List CCR section number: Cal. Code Regs., tit 14, § 15301 ; Cal. Code Regs., tit 14, § 15306

Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section: Class 6 projects consists of basic data collection, research, experimental management and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. This project will test and validate a



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green electrolytic hydrogen storage system on existing equipment in an existing facility. For these reasons, the project will not have a significant effect on the environment and falls under the categorical exemption listed in 14 C.C.R. 15306.

Class 1 projects consists of operation or minor alteration of existing facilities or mechanical equipment involving negligible or no expansion of existing or former use. The project will involve simple connection and configuration changes implemented on existing equipment at the existing site. The project will not require any site construction activities and will have no direct impacts on the site. The operations and minor alterations will have negligible or no expansion of existing uses of the facility. For these reasons, the project will not have a significant effect on the environment and falls under the categorical exemption listed in 14 C.C.R. 15301.

Each exemption is an independent basis for finding the project exempt.

- b) Agreement **IS NOT** exempt. (consult with the legal office to determine next steps)

Check all that apply

- Initial Study
- Negative Declaration
- Mitigated Negative Declaration
- Environmental Impact Report
- Statement of Overriding Considerations

H) List all subcontractors (major and minor) and equipment vendors: (attach additional sheets as necessary)

Legal Company Name:	Budget
SAFCELL, INC.	\$ 90,000
LONGITUDE 122 WEST, INC.	\$ 60,000
Bhupatrai R. Mehta	\$ 60,000
Quadrogen, Inc.	\$ 90,000
Timothy Lipman	\$ 90,000
BEROKOFF ENERGY SOLUTIONS, INC.	\$ 20,000
GREENBIZ GROUP INC.	\$ 5,000
SIMEKEN, INC.	\$ 5,000
California Hydrogen Business Council	\$ 2,500
TBD - Contractor	\$ 2,500

I) List all key partners: (attach additional sheets as necessary)

Legal Company Name:



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J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	18-19	301.001F	\$995,250
			\$
			\$
			\$
			\$
			\$

R&D Program Area: ESRO: ETSI

TOTAL: \$ 995,250

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:

K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Ludwig Lipp

Address: 516 S Fairfax Ave

City, State, Zip: Los Angeles, CA
90036-3132

Phone: 203-300-6130

E-Mail: llipp@t2mglobal.com

2. Recipient's Project Manager

Name: Pinakin Patel

Address: 516 S Fairfax Ave

City, State, Zip: Los Angeles, CA
90036-3132

Phone: 230-300-6130

E-Mail: ppatel@t2mglobal.com

L) Selection Process Used

Competitive Solicitation Solicitation #: GFO-19-305

First Come First Served Solicitation Solicitation #:

M) The following items should be attached to this GRF

- | | | |
|---|---|--|
| 1. Exhibit A, Scope of Work | <input checked="" type="checkbox"/> | Attached |
| 2. Exhibit B, Budget Detail | <input checked="" type="checkbox"/> | Attached |
| 3. CEC 105, Questionnaire for Identifying Conflicts | <input checked="" type="checkbox"/> | Attached |
| 4. Recipient Resolution | <input checked="" type="checkbox"/> N/A | <input type="checkbox"/> Attached |
| 5. CEQA Documentation | <input type="checkbox"/> N/A | <input checked="" type="checkbox"/> Attached |

Agreement Manager

Date



STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 12/2019)

CALIFORNIA ENERGY COMMISSION

Office Manager

Date

Deputy Director

Date

**Exhibit A
Scope of Work
T2M Global, LLC**

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2	1	Advanced Electrolyzer for Energy Storage
3		Module Design for Demonstration Readiness
4	2	Measurement & Verification
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities
7		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
AES	Advanced Electrolyzer System
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
FCE	FuelCell Energy
H ₂	Hydrogen
IOU	Investor Owned Utility
kW	Kilowatt
MW	Megawatt
OCV	Open Circuit Voltage
TAC	Technical Advisory Committee
T2M	T2M Global, LLC

II. PURPOSE OF AGREEMENT, PROBLEM/SOLUTION STATEMENT, AND GOALS AND OBJECTIVES

A. Purpose of Agreement

The purpose of this agreement is to fund innovative energy storage research projects. This project aims to develop and validate green electrolytic hydrogen storage systems in customer side of the meter applications with an electricity-in and electricity-out capability.

B. Problem/ Solution Statement

Problem

Senate Bill 350 (de León, Chapter 547, Statutes of 2015) and Senate Bill 100 (de León, Chapter 312, Statutes of 2018) cannot be met with currently fielded technologies alone, because they do not have the energy density, daily cycle capability, longevity, safety, and price to be viable for the diverse set of applications that will be needed in the State. SB-1369 (Skinner, Chapter 567, Statutes of 2018) identifies the need for the Energy Commission to “consider green electrolytic

¹ Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

Exhibit A Scope of Work T2M Global, LLC

hydrogen an eligible form of energy storage, and shall consider other potential uses of green electrolytic hydrogen.”

The timing is right for supporting emerging technologies that can out-perform existing energy storage technologies because a substantial amount of the energy storage in California was installed in the last few years and will need to be upgraded or replaced in the next 7-15 years. Additionally, as the State makes changes to the electric grid to accommodate higher levels of renewables and a carbon free future by 2045, the need for cost effective and high performing energy storage solutions is expected to increase and be diversified. This means that developing new and emerging technologies now will enable them to be positioned for substantial upcoming market opportunities.

Conventional Water Electrolysis has Serious Challenges: Traditional water electrolysis for electricity-in (e-Hydrogen (e-H₂)), and the fuel cell systems for electricity-out, are proven commercially. Electric utilities working with EPRI have studied scenarios deploying conventional water electrolyzers for energy storage and demand response to variations in the grid: frequency response, reactive power for power factor correction, load ramp-up and ramp-down in kW/sec or kW/min, etc. Their key conclusions include low round-trip electrical efficiencies: <40%, as compared to batteries at >80%. The combined capital cost of an electrolyzer and fuel cell is prohibitively high (>\$3000/kW). Also, there is a safety concern: the large volumes of pressurized hydrogen and oxygen co-produced from water in the presence of electricity pose potential fire and explosion hazards. This will be a permitting issue, especially for deployment in disadvantaged communities, which have traditionally suffered from such safety, health and fire hazards.

Solution

The Recipient has been working on improving water electrolysis issues to develop a safer and cost-effective solution suitable for microgrids in California, including deployments in disadvantaged communities. The recipient has systematically identified contributing factors for these issues, developed technology approaches to mitigate them, leading to the basis of the proposed Advanced Electrolyzer System (AES).

The proposed AES technology will be developed and validated, and designs will be developed for a commercial scale AES system with the potential to address the above barriers using innovative and cost-effective approaches.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Develop and validate the AES energy storage system technology for electricity-in/electricity-out applications
- Perform pilot-scale testing of baseline and improved AES technology to raise the TRL level of the technology
- Develop designs for a commercial scale AES system that validate its energy storage capabilities and ability to support renewable power reliability at lower cost and higher efficiency for Investor Owned Utilities (IOU) and behind-the-meter applications.
- Establish readiness for scale-up and prototype development for microgrid deployment

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Ratepayer Benefits:² This project will result in the ratepayer benefits by validating the AES technologies' capability to provide: greater electricity reliability, lower costs, and increased safety by managing the intermittency of generation by renewable sources such as wind or solar. By storing excess energy generated by these sources during times of low demand, the proposed system could improve grid reliability by providing ultra-rapid response to increases in-grid demand through discharging the stored energy. This would help to mitigate the asynchronous generation of solar and wind sources and its impact on the electrical grid, as well as facilitate the deployment of these technologies in order to meet the State of California's 2045 energy goals and AB-2514 and SB-1369. The AES technology may provide electricity-out at a significantly lower cost than conventional spinning reserve technologies, as it does not consume significant quantities of fuel while idling or generating power. Compared to traditional battery systems or water electrolyzer used for storing energy, the AES technology has much lower risks of failure and improved safety.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and breakthroughs by eliminating the barriers associated with conventional water electrolyzer systems cost-effectively by cleverly deploying currently wasted streams in the emerging green-tech sector. It will produce green electrolytic H₂ from these stranded assets - currently estimated at >2,000 GWh/yr (tail gases from biomass gasification, liquid biofuels, biogas-fueled reformers and fuel cells, etc.). The following unique technology features lead to game-changing advantages:

Ultra-high Electrical Efficiency at Enhanced Safety & Lower Cost means oxygen-free electrolysis dramatically reduces electricity use, from >50 to <10 kWh/kg H₂ (less Platinum, no fire hazard). Thermal integration for Rapid Response, range extension results in efficient waste heat recovery and reuse. Operating flexibility for a variety of Dilute/Waste H₂ Streams allows for electrolysis stack capable of handling impurities, such as CO - up to 10% (very attractive for deployment). Integrated Electrolysis with H₂ Storage device enables H₂ production and storage in the same pressure vessel, thereby eliminating separate higher-cost compressed H₂ storage and safety equipment. This reduces energy storage system cost and footprint for faster deployment in Disadvantaged and Low-income Communities.

Agreement Objectives

The objectives of this Agreement are to:

- Design an integration module to control and regulate AES storage system interactions
- Provide proof-of-concept pilot scale testing for a kW-class hybrid system for utility integration
- Develop a conceptual design of a commercial scale AES system

² California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).

³ California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

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Scope of Work
T2M Global, LLC

- Assess, quantify and validate the performance of the proposed AES energy storage technology and benefits to IOUs and California ratepayers
- Develop a production readiness plan to enable near-term commercialization of the AES system

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III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products

- Submit all data and documents required as products in accordance with the following Instructions for Submitting Electronic Files and Developing Software:
 - **Electronic File Format**
 - Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the Energy Commission’s software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

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The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
 - Text documents will be in MS Word file format, version 2007 or later.
 - Documents intended for public distribution will be in PDF file format.
 - The Recipient must also provide the native Microsoft file format.
 - Project management documents will be in Microsoft Project file format, version 2007 or later.
- **Software Application Development**
- Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
 - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
 - Visual Studio.NET (version 2008 and up). Recommend 2010.
 - C# Programming Language with Presentation (UI), Business Object and Data Layers.
 - SQL (Structured Query Language).
 - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
 - Microsoft SQL Reporting Services. Recommend 2008 R2.
 - XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy Commission's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other Energy Commission staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

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The administrative portion of the meeting will include discussion of the following:

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Technical products (subtask 1.1);
 - Progress reports and invoices (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide an *Updated Project Schedule, List of Match Funds, and List of Permits*, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

Recipient Products:

- Updated Project Schedule (*if applicable*)
- Updated List of Match Funds (*if applicable*)
- Updated List of Permits (*if applicable*)

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

The goal of this subtask is to determine if the project should continue to receive Energy Commission funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the Energy Commission and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient, and may include the CAO and any other individuals selected by the CAM to provide support to the Energy Commission.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the Energy Commission, but they may take

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place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

- Prepare a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

- CPR Report(s)
- Task Products (draft and/or final as specified in the task)

CAM Products:

- CPR Agenda
- List of Expected CPR Participants
- Schedule for Providing a Progress Determination
- Progress Determination

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

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The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any state-owned equipment.
 - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
 - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
 - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary (*if applicable*)
- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions, including a financial report on Match Fund and in-state expenditures.

Products:

- Progress Reports
- Invoices

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Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM. (See *Task 1.1* for requirements for draft and final products.)

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
 - Ensure that the report includes the following items, in the following order:
 - Cover page (**required**)
 - Credits page on the reverse side of cover with legal disclaimer (**required**)
 - Acknowledgements page (optional)
 - Preface (**required**)
 - Abstract, keywords, and citation page (**required**)
 - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
 - Executive summary (**required**)
 - Body of the report (**required**)
 - References (if applicable)
 - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
 - Bibliography (if applicable)
 - Appendices (if applicable) (Create a separate volume if very large.)
 - Attachments (if applicable)
 - Ensure that the document is written in the third person.
 - Ensure that the Executive Summary is understandable to the lay public.
 - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.

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- Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
- If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
- Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
- Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
- Include a brief description of the project results in the Abstract.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:

- Final Report (draft and final)
- Written Responses to Comments on the Draft Final Report

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. 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 this in the letter.

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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 cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the 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 Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
 - If different from the solicitation application, provide a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

- Match Funds Status Letter
- Supplemental Match Funds Notification Letter (*if applicable*)
- Match Funds Reduction Notification Letter (*if applicable*)

Subtask 1.8 Permits

The goal of this subtask 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 not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
 - The schedule the Recipient will follow in applying for and obtaining the permits.

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not

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obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

- Permit Status Letter
- Updated List of Permits (*if applicable*)
- Updated Schedule for Acquiring Permits (*if applicable*)
- Copy of Each Approved Permit (*if applicable*)

Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Subcontracts (Final)

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
 - Technical area expertise;
 - Knowledge of market applications; or

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- Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed. The list shall include the expertise of each proposed TAC member and the value to the project.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

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The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

The TAC shall:

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

Products:

- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

Exhibit A Scope of Work T2M Global, LLC

TECHNICAL TASKS

Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.

TASK 2: ADVANCED ELECTROLYZER FOR ENERGY STORAGE

The goals of this task are to complete design requirements for the baseline and improved AES system, complete data collection of conventional electrolysis and fuel cell systems for benchmarking, develop engineering-scale testing approach, and test baseline and improved AES system components.

The Recipient shall:

- Prepare an *AES Test Report* describing the system configuration, performance and technology features, and make comparisons with traditional water electrolyzers.
 - Identify key technical specifications that may include but not be limited to:
 - H₂ Storage Capacity (kWh/kg of H₂)
 - Response Time (kW/s, MW/s)
 - Size (kW, MW unit)
 - Capital Cost (\$/kW)
 - Develop an engineering scale AES system design (kW class)
 - Procure AES components
 - Develop testing approach to evaluate baseline AES and improved AES system performance. The approach will be documented in Task 4.
 - Evaluate baseline AES system performance through measurement and experimentation
 - Analyze test data
 - Design and procure improved AES components
 - Evaluate improved AES system performance through measurement and experimentation
 - Compare performance of baseline AES and improved AES system configurations.
- Prepare *CPR Report #1* and participate in a CPR Meeting, per subtask 1.3

Products:

- AES Test Report (D201)
- CPR Report #1 (Draft and Final) (D131 and D132)

TASK 3: MODULE DESIGN FOR DEMONSTRATION READINESS

The goal of this task is to leverage pilot-scale AES operation data from Task 2 to design a commercial scale AES system suitable for deployment in multiple market segments and aid in developing a commercialization plan.

The Recipient shall:

- Prepare a *Conceptual Commercial Scale AES System Design Report* describing the planned configuration of the commercial scale AES system, as well as a summary of the key factors that lead to the final design (such as design changes resulting from: cost considerations, operational considerations, or permitting requirements).

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- Evaluate commercial scale AES system application flexibility in dual/reversible mode to serve as an integrated electricity-in/electricity-out solution
- Conduct waste stream analysis to study different dilute H2 sources and identify system parameters that need to be optimized for different market applications
- Develop a revised commercial scale AES system design that may include refinement of system parameters and or system components such as:
 - DC controllers
 - Stacks

Products:

- Conceptual Commercial Scale AES System Design Report (D301)

TASK 4: MEASUREMENT AND VERIFICATION

The goal of this task is to establish a detailed methodology for measurement and verification of the system, and to evaluate the system performance in terms of energy use, cost, and greenhouse gas emissions.

The Recipient shall:

- Prepare a *Measurement and Verification Plan* that will detail the system parameters that will be measured to evaluate system performance, the baseline metrics and performance improvement goals, as well as the verification methodology that will be used to validate the results.
- Prepare a *Measurement and Verification Report* that will detail the validated measured system performance, the baseline metrics and performance achieved, the data sources and analytical methodology used in the evaluations of system performance, energy use and greenhouse gas emissions. Costs and benefits will be evaluated from the perspective of customers and ratepayers.
- Prepare *CPR Report #2* and participate in a CPR Meeting, per subtask 1.3

Products:

- Measurement and Verification Plan (Draft and Final) (D401 and D402)
- Measurement and Verification Report (Draft and Final) (D403 and D404)
- D133 CPR Report #2 (Draft and Final) (D133 and D134)

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TASK 5: EVALUATION OF PROJECT BENEFITS

The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
 - For Product Development Projects and Project Demonstrations:
 - Published documents, including date, title, and periodical name.
 - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
 - Greenhouse gas and criteria emissions reductions.
 - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
 - Additional Information for Product Development Projects:
 - Outcome of product development efforts, such copyrights and license agreements.
 - Units sold or projected to be sold in California and outside of California.
 - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
 - Investment dollars/follow-on private funding as a result of Energy Commission funding.
 - Patent numbers and applications, along with dates and brief descriptions.
 - Additional Information for Product Demonstrations:
 - Outcome of demonstrations and status of technology.
 - Number of similar installations.
 - Jobs created/retained as a result of the Agreement.
 - For Information/Tools and Other Research Studies:
 - Outcome of project.
 - Published documents, including date, title, and periodical name.
 - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
 - The number of website downloads.

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- An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
 - An estimate of energy and non-energy benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

Products:

- Kick-off Meeting Benefits Questionnaire (D501)
- Mid-term Benefits Questionnaire (D502)
- Final Meeting Benefits Questionnaire (D503)

TASK 6: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

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

The Recipient shall:

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
 - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
 - A description of the intended use(s) for and users of the project results.
 - Published documents, including date, title, and periodical name.
 - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
 - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
 - The number of website downloads or public requests for project results.
 - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(s) on the project.

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- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

- Initial Fact Sheet (draft) (D601)
- Initial Fact Sheet (final) (D602)
- Final Project Fact Sheet (draft) (D603)
- Final Project Fact Sheet (final) (D604)
- Presentation Materials (draft) (D605)
- Presentation Materials (final) (D606)
- High Quality Digital Photographs (D607)
- Technology/Knowledge Transfer Plan (draft) (D608)
- Technology/Knowledge Transfer Plan (final) (D609)
- Technology/Knowledge Transfer Report (draft) (D610)
- Technology/Knowledge Transfer Report (final) (D611)

TASK 7: Production Readiness Plan

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
 - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
 - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
 - The estimated cost of production.
 - The expected investment threshold needed to launch the commercial product.
 - An implementation plan to ramp up to full production.
 - The outcome of product development efforts, such as copyrights and license agreements.
 - Patent numbers and applications, along with dates and brief descriptions.
 - Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft) (D701)
- Production Readiness Plan (final) (D702)

**Exhibit A
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IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

**STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION**

RESOLUTION - RE: T2M GLOBAL, LLC.

RESOLVED, that the State Energy Resources Conservation and Development Commission (CEC) adopts the staff CEQA findings contained in the Agreement or Amendment Request Form (as applicable); and

RESOLVED, that the CEC approves Agreement EPC-19-044 with T2M Global, LLC for a \$995,250 grant to develop and validate an Advanced Electrolyzer System (AES) that employs an innovative approach for increasing net electrical system efficiency by recovering dilute hydrogen from wastes and resources such as ammonia and gasified biomass. The AES electrolyzer stack is reversible and can operate in fuel cell mode to convert the stored hydrogen back to electricity. A small-scale system will be tested in a laboratory setting to validate the system performance under controlled conditions; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the CEC.

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the CEC held on June 10, 2020.

AYE:

NAY:

ABSENT:

ABSTAIN:

Cody Goldthrite
Secretariat