STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 12/2019) CALIFORNIA ENERGY COMMISSION

A) New Agreement # EPC-21-009

B) Division	Agreement Manager:	MS-	Phone
ERDD	Mei Chang		916-776-0741

C) Recipient's Legal Name	Federal ID Number
OnTo Technology LLC	74-3080324

D) Title of Project
Cathode-Healing for Recycling and Manufacturing of Lithium-ion Batteries

E) Term and Amount

Start Date	End Date	Amount
8/30/2021	3/31/2026	$ 1,001,807

F) Business Meeting Information

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

Proposed Business Meeting Date 8/11/2021 ☐ Consent ☒ Discussion

Business Meeting Presenter Ben Wender Time Needed: 5 minutes

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

Agenda Item Subject and Description:
OnTo Technology LLC. Proposed resolution approving Agreement EPC-21-009 with OnTo Technology LLC for a $1,001,807 grant for research and development of life lithium-ion battery recycling processes and manufacturing new batteries made with one hundred percent recycled electrodes, and adopting staff's determination that this action is exempt from CEQA. (EPIC funding) Contact: Ben Wender.

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

   Explain reason why Agreement is exempt under the above section: This project is exempt under Cal. Code Regs., tit. 14, Section 15301, because all activities will take place in existing facilities, permitted for collection and storage of used lithium-ion batteries.

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**
Oregon State University	$ 97,934
Global Risk Intelligence and Planning (GRIP, Inc.)	$ 7,500
Saft America, Inc.	$ 99,404
Electric Power Research Institute, Inc.	$ 56,190
Schnitzer Steel Industries, Inc.	$ 0
Heritage Battery Recycling, LLC	$ 0
Renewance Inc.	$ 7,500

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

Legal Company Name:

J) Budget Information

Funding Source	**Funding Year of Appropriation**	**Budget List Number**	**Amount**
EPIC	20-21	301.001H	$1,001,807

R&D Program Area: EGRO: Transportation TOTAL: $ 1,001,807

Explanation for “Other” selection

Reimbursement Contract #: Federal Agreement #:

K) Recipient’s Contact Information

1. Recipient’s Administrator/Officer

Name: Steven Sloop

Address: 63221 Service Rd Ste 6

City, State, Zip: Bend, OR 97703-6640

Phone: 541--389-7897

E-Mail: ssloop@onto-technology.com

2. Recipient’s Project Manager

Name: Steven Sloop

Address: 63221 Service Rd Ste 6

City, State, Zip: Bend, OR 97703-6640

Phone: 541--389-7897

E-Mail: ssloop@onto-technology.com

L) Selection Process Used

☒ Competitive Solicitation Solicitation #: GFO-20-308
☐ First Come First Served Solicitation Solicitation #:
☐ Non-Competitive Bid Follow-on Funding (SB 115)

M) The following items should be attached to this GRF

1.	Exhibit A, Scope of Work		☒ Attached
2.	Exhibit B, Budget Detail		☒ Attached
3.	CEC 105, Questionnaire for Identifying Conflicts		☒ Attached
4.	Recipient Resolution	☒ N/A	☐ Attached
5.	CEQA Documentation	☐ N/A	☒ Attached

Agreement Manager **Date**

Office Manager **Date**

Deputy Director **Date**

Exhibit A

Scope of Work

Onto Technology LLC

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		Obtain, Develop Test Plans, and Perform Diagnostics on EOL Batteries from California
3	X	Scale-Up and Optimize Cathode-Healing for Large Format EOL Lithium-Ion Batteries
4		Validate Performance of Recycled Material from Cathode-Healing with a Batter Manufacturer
5	X	Life Cycle Analysis and Cost Modeling to Inform Scale-Up
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
EOL	End of Life
EPRI	Electric Power Research Institute
ESS	Energy Storage System
EV	Electric Vehicle
LCA	Life Cycle Analysis
LFP	Lithium iron phosphate

[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.

NCM	Lithium Nickel Cobalt Manganese Oxide (sometimes seen as "NMC")
TAC	Technical Advisory Committee

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

A. Purpose of Agreement

The purpose of this Agreement is to fund applied research and development of cathode-healing recycling for end of life (EOL) lithium-ion batteries and to manufacture new batteries made with 100% recycled electrodes. The project will increase the technology readiness and processing scale of efficient and cost-effective recycling strategies and demonstrate performance of batteries with high content of recycled materials.

B. Problem/ Solution Statement

Problem

Achieving California state goals for zero emission transportation and zero-carbon electricity systems will require large deployments of lithium-ion batteries in both electric vehicles (EVs) and stationary energy storage systems (ESS). The lithium-ion battery industry is growing rapidly and already produces large volumes of waste batteries that are projected to grow significantly as more products reach EOL. However, currently no cost positive recycling services exist and established recycling processes have negative environmental impacts and safety concerns. These conventional processes produce metal sulfates that are more expensive than mined materials and typically do not meet purity specifications for battery manufacturing. Furthermore, batteries with lithium iron phosphate (LFP) cathodes commonly used in large format batteries (e.g., in buses and utility ESS) cannot be recycled economically using any of the current recycling technologies. Novel direct recycling offers an efficient solution, but the performance of batteries made with recovered materials requires demonstration to build manufacturer confidence.

Solution

The Recipient's patented Cathode-Healing® process provides a low-cost and efficient method to recover electrode and other materials from used batteries and produce manufacturing-ready cathodes at one-tenth the cost and energy than incumbants. In addition, cathode-healing is the only method that can be used to reycle LFP cathodes. Cathode-healing is flexible to chemistry and has successfully demonstrated recycling on most major EV cathode chemistries. The method includes safety measures to remove hazards from end-of-life batteries, which improves public and worker safety during transportation, storage, and processing.

The Recipient is building market confidence for use of recovered cathodes in battery manufacturing through testing and demonstrations with key partners. This project will work in partnership with a U.S. battery manufacturer to demonstrate high quality performance and specifications of batteries made with recycled material. Increasing recycled content in new batteries can help reduce the costs of batteries in EV and ESS, helping economically reach state climate, air quality, and energy goals.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to demonstrate, scale up, and build market acceptance of cathode healing direct recycling processing. The outcomes of the project include the following:

- Demonstration of EV quality battery cells made from 100% recycled cathode and anode
- Validation that cathode-healing recycled electrodes meet manufacturing specifications
- Increased market demand for recycled material and reduced risk for recyclers and manufacturers
- Cost savings for utilities, rate payers, EV drivers and riders, municipalities, and others through lower cost batteries
- Reduced environmental impacts from clean energy technology deployment including batteries with low and no cobalt cathodes

Ratepayer Benefits:[2] This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety by reducing the cost liability for EOL batteries, using patented technology to remove battery hazards, and producing manufacturing quality electrodes at a low cost. Increasing recycled content in manufacturing of new EV and ESS batteries can potentially reduce costs of future deployments. LFP cathode material produced from mined material costs $12-30/kg as of 2021 whereas cathode-healing produces LFP for about $2/kg, which could be sold at a deep market discount for $6/kg.

Technological Advancement and Breakthroughs:[3] This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating, improving, and scaling a direct recycling technology that transforms EOL batteries from a liability to an asset while enabling a circular economy for lithium-ion batteries.

Specific technology advancements targeted in this agreement include:

- Demonstration of cost-positive direct recycling of large format LFP EOL batteries
- Increased process efficiency and reduced energy consumption compared to incumbent recycling methods
- Process optimization and scale-up to reach kgs/day throughput
- Achieve 98% yield for recovered LFP cathode material
- Manufacture first of a kind battery using 100% recycled LFP material

[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).

Exhibit A

Scope of Work

Onto Technology LLC

Agreement Objectives

The objectives of this Agreement are to:

- Improve scalability of cathode-healing® direct recycling by 100 times existing capacity to reach kg/day throughput
- Validate electrodes recovered through cathode-healing® meet manufacturing specifications by benchmarking purity, morphology, and other material characteristics with cathodes made from baseline mined material
- Demonstrate manufacturing quality of recycled LFP cathodes, lithium nickel cobalt manganese oxide (NCM), and graphite anode by producing cells and modules in partnership with a battery manufacturer
    - Demonstrate comparable performance to batteries made from mined materials, including but not limited to capacity and cycle life within 5%.
- Design a pilot facility for cathode-healing and identify capital costs and potential site location
- Model recycling cost and revenue opportunities as well as environmental benefits for scaled cathode-healing® relative to incumbent hydrometallurgical recycling and mined materials
    - Evaluate pathway to reach $3.60/kg and factor of ten energy reduction per kg of manufacturing grade cathode

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).** All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C.

Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations**.** All technical tasks should include product(s). 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 California Energy Commission's (CEC) 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.

The following describes the accepted formats for electronic data and documents provided to the CEC 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.
- 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 CEC'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 CEC 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.

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

  - Terms and conditions of the Agreement;
  - Invoicing and auditing procedures;
  - 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 (subtask 1.5);
- Final Report (subtask 1.6);
- Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
- Any other relevant topics.

- Provide *Kick-off Meeting Presentation* to include but not limited to:
  - Project overview (i.e. project description, goals and objectives, technical tasks, expected benefits, etc.)
  - Project schedule that identifies milestones
  - List of potential risk factors and hurdles, and mitigation strategy

- Provide an *Updated Project Schedule, Match Funds Status Letter,* and *Permit Status Letter*, 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:

- Kick-off Meeting Presentation
- Updated Project Schedule *(if applicable)*
- Match Funds Status Letter (subtask 1.7) *(if applicable)*
- Permit Status Letter (subtask 1.8) *(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 CEC 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 CEC 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 CEC.

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

The Recipient shall:

- Prepare and submit 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.
- 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* with 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)

CAM Products:

- CPR Agenda
- 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 CEC 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.

  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 procured equipment.
    - The CEC'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 copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary *(if applicable)*
- Schedule for Completing Agreement Closeout Activities
- All Final 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 Funds and in-state

expenditures.

Products:

- Progress Reports
- Invoices

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. When creating the Final Report Outline and the Final Report, the Recipient must use the CEC 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 *Energy Commission Style Manual* provided by the CAM.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Energy Commission 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, Energy Commission 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**)
        - Acknowledgement's 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)
- Submit a draft of the Executive Summary to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* received on the Executive Summary. For each comment received, the recipient will identify in the summary the following:
    - Comments the recipient proposes to incorporate.

  - Comments the recipient does propose to incorporate and an explanation for why.

- 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.
- Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments were not incorporated into the final product.
- Submit the revised Final Report electronically with any *Written Responses to Comments* within 10 days of receipt of CAM's Written Comments on the *Draft Final Report*, unless the CAM specifies a longer time period or approves a request for additional time.

Products:

- Summary of TAC Comments
- Draft Final Report
- Written Responses to Comments *(if applicable)*
- 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 CEC 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 CEC awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

  If match funds were a part of the proposal that led to the CEC 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 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 each 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 *(draft if required by the CAM)*

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
    - 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.
- 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, to the extent the TAC members feel is appropriate, 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.

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.

- 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.

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.
- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

Products:

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

Subtask 1.12 Project Performance Metrics

The goal of this subtask is to identify key performance targets for the project. The performance targets should be a combination of scientific, engineering, techno-economic, and/or programmatic metrics that provide the most significant indicator of the research or technology's potential success.

The Recipient shall:

- Complete and submit the draft *Project Performance Metrics Questionnaire* to the CAM prior to the Kick-off Meeting.
- Present the draft *Project Performance Metrics Questionnaire* at the first TAC meeting to solicit input and comments from the TAC members.
- Develop and submit a *TAC Performance Metrics Summary* that summarizes comments received from the TAC members on the proposed project performance metrics. The *TAC Performance Metrics Summary* will identify:
    - TAC comments the recipient proposes to incorporate into the final *Project Performance Metrics Questionnaire*.
    - TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit a final *Project Performance Metrics Questionnaire* with incorporated TAC feedback.
- Develop and submit a *Project Performance Metrics Results* document describing the extent to which the recipient met each of the performance metrics in the final *Project Performance Metrics Questionnaire*.
- Discuss the final *Project Performance Metrics Questionnaire* and *Project Performance Metrics Results* at the Final Meeting.

Products:

- Project Performance Metrics Questionnaire (draft and final)
- TAC Performance Metrics Summary
- Project Performance Metrics Results

IV. TECHNICAL TASKS

TASK 2 OBTAIN, DEVELOP TEST PLANS, AND PERFORM DIAGNOSTICS ON EOL BATTERIES FROM CALIFORNIA

The goal of this task is to obtain large format EOL batteries from California sources with at least two different cathode chemistries based upon LFP and NMC, and to develop and apply detailed test plans for diagnostic characterization of EOL materials.

Subtask 2.1 Obtain EOL Batteries from California with Multiple Cathode Chemistries

The Recipient Shall:

- Obtain EOL EV/bus batteries and ESS batteries from a source in California
- Receive and store the batteries in compliance with all regulations
- Develop a *Logistics Report* that includes, but is not limited to, the following:
    - EOL lithium-ion battery requirements
    - EOL battery availability and sourcing options and explanation
    - Battery weight, dimensions, and energy capacity
    - Regulatory compliance measures taken
    - Costs for labor, packaging, and storage
    - Transportation costs and associated emissions

Products:

- Logistics Report

Subtask 2.2 Develop Test Plans and Perform Diagnostic Characterization of EOL Batteries

The Recipient shall:

- Inspect the modules and cells for any damage and assess the state of charge
- Discharge, open cells, and gather cathode and anode samples for subsequent analyses
- Develop *Detailed Test Plans* (draft and final) describing protocols and methods for characterizing electrode materials before, during, and after treatment, including

  - Techniques to evaluate crystal structure, purity, composition, morphology, process yield, and/or other relevant properties, including but not limited to:
    - X-ray diffraction
    - Scanning electron microscopy
    - Ion-chromatograph and gas chromatography mass spectrometry
    - X-ray photoelectron spectroscopy
  - Techniques for safe fabrication and testing of half cells for use as baseline for comparison, including but not limited to capacity testing
- Prepare an *EOL Battery Diagnostics Report* (draft and final) that summarizes results of physical, chemical, and other measurements described in the test plan to provide a baseline for comparison with materials after cathode-healing treatment.

Products:

- Detailed Test Plan (draft and final)
- EOL Battery Diagnostics Report (draft and final)

TASK 3 SCALE-UP AND OPTIMIZE CATHODE-HEALING FOR LARGE FORMAT EOL LITHIUM-ION BATTERIES

The goals of this task are to scale-up the throughput of cathode-healing® direct recycling of electrode materials by a factor of 100 to achieve production levels of kgs per day, and to improve the cathode-healing process to minimize the energy and material inputs.

Subtask 3.1 Develop, Optimize, and Demonstrate Cathode-healing for EOL LFP Bus Batteries

The Recipient shall:

- Prepare 1-2 kg batches of harvested electrode material from LFP bus batteries and process through cathode healing® treatment, including thermal, physical, and chemical processes to produce recycled LFP electrodes for analyses

- Optimize processes and document a *Generic LFP Cathode-Healing Process Description (*draft and final) that will include, but is not limited to:
    - General descriptions of processing activities including process steps, total process time, types and ranges of materials inputs and outputs, and strategies for improving processes
- Characterize recycled anode and cathode materials following detailed test plan (Task 2) and prepare a *Recycled LFP Electrode Test Report*
- Develop a *LFP Recycling Materials and Energy Report* that describes measurements and estimates of material inputs and costs as well as energy usage for all process steps per unit mass of recycled material produced

Products:

- Generic LFP Cathode-Healing Process Description (draft and final)
- Recycled LFP Electrode Test Report
- LFP Recycling Materials and Energy Report

Subtask 3.2 Develop, Optimize, and Demonstrate Cathode-healing for EOL Large Format NMC batteries.

The Recipient shall:

- Prepare 1-2 kg batches of harvested electrode material from NMC large format batteries and process through cathode healing® treatment, including thermal, physical, and chemical processes to produce recycled LFP electrodes for analyses
- Optimize processes and develop a *Generic NMC Cathode-Healing Process Description* (draft and final) that will include, but is not limited to:
    - General descriptions of processing activities including total process time, types and ranges of materials inputs and outputs, and strategies for improving processes.
- Characterize recycled anode and cathode materials following detailed test plan (Task 2) and prepare a *Recycled NMC Electrode Test Report*
- Develop an *NMC Recycling Materials and Energy Report* that describes measurements and estimates of material inputs and costs as well as energy usage for all process steps per unit mass of recycled material produced.
- Participate in a CPR meeting in accordance with subtask 1.3 (CPR Meetings)

- Prepare *CPR #1 Report*.

Products:

- Generic NMC Cathode-Healing Process Description (draft and final)
- Recycled NMC Electrode Test Report
- NMC Recycling Materials and Energy Report
- CPR Report #1

Subtask 3.3 Produce Materials Qualification Report for LFP and NMC

The Recipient shall:

- Develop a *Manufacturer Materials Qualification Report* (draft and final) based on Task 2 and Task 3 that documents validation that recovered LFP and NMC cathodes as well as anode materials meet common manufacturer specifications including but not limited to the following:
    - Specific capacity for half cells (mAh/g)
    - Rate capability for half cells
    - Efficiency for half cells
    - Electrode Purity
    - Yield
    - Particle Size Distribution
    - % active material
    - Particle morphology
    - SEM images

Products:

- Manufacturer Materials Qualification Report (draft and final)

TASK 4 VALIDATE PERFORMANCE OF RECYCLED MATERIAL FROM CATHODE-HEALING WITH A BATTERY MANUFACTURER

The goals of this task are to validate the performance of recycled electrode materials recovered through cathode-healing (Task 3) with a commercial battery manufacturer by building and cycling full battery cells and comparing results to baseline material.

Subtask 4.1 Build Full Cells with Electrodes Recycled Through Cathode-Healing With Battery Manufacturing Partner

The Recipient shall:

- Work with battery manufacturing partners to produce 36 full lithium-ion cells, including twelve 2 Ah recycled LFP and twelve 2 Ah recycled NMC cells both using recycled graphite, for testing and performance verification. Develop a *Cell Specifications Document* that describes cell building parameters including but not limited to the following:
    - General fabrication processes
    - % recycled material
    - Anode material

Products:

- Cell Specification Document

Subtask 4.2 Cycle and Evaluate Full Cells and Obtain Third-Party Validation

The Recipient shall:

- Cycle cells using cell testing equipment and obtain third-party verification. Perform diagnostic testing on cell materials after cycling following the Detailed Test Plan (Task 2) and prepare *Cathode Healing Performance Report*
- Analyze and provide cell cycling data to develop a *Cathode-Healing Battery Performance Report.*
    - Cycle life

- Capacity fade (%) after intervals of 500 cycles
- % capacity fade vs. time,
- fade rate compared to reasonable baseline material
- capacity and format of cells
- Compare *to EOL Battery Diagnostics Report* (Task 2)

- Use cells to build an EV relevant module and measure capacity and cycling.

Products

- Cathode-Healing Battery Performance Report

TASK 5 LIFE CYCLE ANALYSIS AND COST MODELING TO INFORM SCALE UP

The goals of this task are to evaluate environmental and cost benefits of cathode-healing using life Cycle Analysis (LCA) based on directly measured input values from the cathode-healing process for different cathode compositions (Task 3). LCA emissions and energy data will be compared to other recycling technologies and manufacturing with mined material and cost modeling will inform pilot facility design.

Subtask 5.1 Perform Life Cycle Analyses

The Recipient shall:

- Perform a critical literature review of LCAs for energy storage EOL management comparing multiple impact categories (e.g. GHG emissions) and develop a *Summary Of Regulatory And Policy Actions Relevant To Lithium-Ion Battery EOL Management* that
  - Reviews policies and voluntary guidelines supporting environmental responsibility of supply chain activities across the US and specifically in California.
- Develop LCA models from EOL shipping to manufacturing and compare results to other recycling processes. Prepare a *Life Cycle Analysis Report* (draft and final) that quantifies environmental burdens across multiple impact categories and energy consumption data for:
  - LFP cathode healing compared to mined materials based on equivalent performance;

  - NMC cathode healing compared to mined materials and other recycling processes based on equivalent performance
  - Process design and improvement considerations to reduce impacts or identify tradeoffs.
- Create and publish a freely available *Technology Brief Report* as part of Technology Transfer (Task 7) summarizing ongoing research and development on novel battery recycling and reuse techniques.

Products:

- Regulatory and Policy Actions Relevant To Lithium-Ion Battery EOL Management Summary
- Technology Brief Report
- Life Cycle Analysis Report (draft and final)

Subtask 5.2 Develop Scale-Up Cost Models

The Recipient shall:

- Prepare a *Pro-Forma for the Pilot* (draft and final) that includes costs and market analyses of revenue streams, including:
  - Cost estimates for scale-up and operation of the cathode-healing pilot facility at approximately 1,000 tons per year of batteries, including but not limited to:
    - Capital equipment costs
    - Site, facility, and permitting
    - Operating costs
      - Labor
      - Energy
      - Materials and consumables
      - Water and water treatment
  - Market analyses and estimates of value of revenue streams from:
    - Healed LFP
    - Healed NCM
    - Recycled graphite
    - Clean aluminum foils
    - Clean copper foils

- Solicit feedback from business consultants, develop written feedback, and revise the *Pro-Forma for the Pilot*
- Work with consultants to perform a *Market Study*
    - Identify potential customers
    - Customer needs
    - Market prices and trends
- Participate in a CPR meeting in accordance with subtask 1.3 (CPR Meetings)
- Prepare *CPR Report #2*.

Products:

- Pro-Forma for the Pilot (draft and final)
- Market Study
- CPR Report #2

TASK 6 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:

    - <u>For Product Development Projects and Project Demonstrations:</u>

        - 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.
- 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 CEC may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

Products:

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

TASK 7 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

Exhibit A

Scope of Work

Onto Technology LLC

The goal of this task is to conduct activities that will accelerate the commercial adoption of the technology being supported under this agreement. Eligible activities include, but are not limited to, the following:

- Scale-up analysis including manufacturing analysis, independent design verification, and process improvement efforts.
- Technology verification testing, or application to a test bed program located in California.
- Market research, business plan development, and cost-performance modeling.
- Entry into an incubator or accelerator program located in California.

The Recipient Shall:

- Develop and submit a Technology Transfer Plan (Draft/Final) that identifies the proposed activities the recipient will conduct to accelerate the successful commercial adoption of the technology.
- Present the Draft Technology Transfer Plan to the TAC for feedback and comments.
- Develop and submit a Summary of TAC Comments that summarizes comments received from the TAC members on the Draft Technology Transfer Plan. This document will identify:
    - TAC comments the recipient proposes to incorporate into the *Final Technology Transfer Plan*.
    - TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit the Final Technology Transfer Plan to the CAM for approval.
- Implement activities identified in Final Technology Transfer Plan.
- Develop and submit a Technology Transfer Summary Report (Draft/Final) that includes high level summaries of the activities, results, and lessons learned of tasks performed relating to implementing the Final Technology Transfer Plan. This report should not include any proprietary information.
- When directed by the CAM, develop presentation materials for an CEC- sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the CEC.

- 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.

Products:

- Technology Transfer Plan (Draft/Final)
- Summary of TAC Comments
- Technology Transfer Summary Report (Draft/Final)
- High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet

RESOLUTION NO: 21-0811-10b

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION ONTO TECHNOLOGY 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-21-009 with OnTo Technology LLC for a $1,001,807 grant for research and development of lithium-ion battery recycling processes and manufacturing new batteries made with one hundred percent recycled electrodes; 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 CEC 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 August 11, 2021.

AYE:
NAY:
ABSENT:
ABSTAIN:

_____
Liza Lopez
Secretariat