



**CALIFORNIA  
ENERGY COMMISSION**



**California Energy Commission  
August 14, 2024 Business Meeting  
Backup Materials for Nelumbo Inc.**

The following backup materials for the above-referenced agenda item are available in this PDF packet as listed below:

1. Proposed Resolution
2. Grant Request Form
3. Scope of Work

**[PROPOSED]**

**RESOLUTION NO: 24-0814-14d**

**STATE OF CALIFORNIA**

**STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION**

**RESOLUTION: Nelumbo Inc.**

**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-24-014 (GFO-23-301) with Nelumbo Inc. for a \$2,910,550 grant. This agreement will take place in Hayward and develop an advanced nano-structured ceramic coating for refrigeration coils to reduce energy usage during the refrigeration defrost cycle by reducing frost formation, rate of growth, and enhancing frost removal; and

**FURTHER BE IT RESOLVED**, that the Executive Director or their 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 14, 2024.

AYE:

NAY:

ABSENT:

ABSTAIN:

Dated:

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Kristine Banaag  
Secretariat



## GRANT REQUEST FORM (GRF)

### A. New Agreement Number

**IMPORTANT:** New Agreement # to be completed by Contracts, Grants, and Loans Office.

**New Agreement Number:** EPC-24-014

### B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Christian Fredericks
3. MS-:51
4. Phone Number: 916-776-0755

### C. Recipient's Information

1. Recipient's Legal Name: Nelumbo Inc.
2. Federal ID Number: 81-2841155

### D. Title of Project

Title of project: Demonstration & Deployment of Nelumbo's Ice-Nein Evaporator Coating

### E. Term and Amount

1. Start Date: 8/14/2024
2. End Date: 3/31/2027
3. Amount: \$2,910,550.00

### F. Business Meeting Information

1. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 8/14/2024 .
3. Consent or Discussion? Consent
4. Business Meeting Presenter Name: Christian Fredericks
5. Time Needed for Business Meeting: 10 minutes.
6. The email subscription topic is: EPIC (Electric Program Investment Charge). **Agenda**

#### **Item Subject and Description:**

Nelumbo Inc. Proposed resolution approving agreement EPC-24-014 (GFO-23-301) with Nelumbo Inc. for a \$2,910,550 grant, and adopting staff's determination that this project is exempt from CEQA. This agreement will take place in Hayward and develop an advanced nano-structured ceramic coating for refrigeration coils to reduce energy usage during the refrigeration defrost cycle by reducing frost formation, rate of growth, and enhancing frost removal.

### G. California Environmental Quality Act (CEQA) Compliance

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

Yes

If yes, skip to question 2.

If no, complete the following (PRC 21065 and 14 CCR 15378) and explain why Agreement is not considered a "Project":



Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because:

**2. If Agreement is considered a “Project” under CEQA answer the following questions.**

a) Agreement **IS** exempt?

Yes

Statutory Exemption?

No

If yes, list PRC and/or CCR section number(s) and separate each with a comma. If no, enter “None” and go to the next question.

PRC section number: None

CCR section number: None

Categorical Exemption?

Yes

If yes, list CCR section number(s) and separate each with a comma. If no, enter “None” and go to the next question.

CCR section numbers: Cal. Code Regs, tit. 14, §§ 15301, 15306

No

If yes, explain reason why Agreement is exempt under the above section. If no, enter “Not applicable” and go to the next section.

California Code of Regulations, title 14, section 15301, provides that projects which consist of the operation, repair, maintenance, permitting, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of existing or former use, are categorically exempt from the provisions of the California Environmental Quality Act (CEQA). This project involves upgrading an existing facility’s refrigeration system with enhanced evaporator coils that will have a similar cooling capacity. The new system will take up the same amount of space and does not involve adding additional square footage to the facility. The updated refrigeration system uses less power and will not result in an additional electrical load. The project will take place at an existing, developed site on land that is not environmentally sensitive. No historical resources or building will be affected. Noise and odors will not be generated by this activity in excess of existing permitted amounts. The project will not increase traffic to the site and will not require permits for air, water, conditional use, building expansion, hazardous waste, or rezoning. Therefore, the project is exempt from CEQA under section 15301.

California Code of Regulations, title 14, section 15306, provides that projects which consist of basic data collection, research, experimental management, and resources evaluation activities which do not result in a serious or major disturbance to an environmental resource are categorically exempt from the provisions of CEQA. This project involves upgrading an existing facility’s refrigeration system with enhanced evaporator coils that will have a similar cooling capacity and will entail data collection, research, and experimental management that will not result in serious or major



disturbances to an environmental resource. Therefore, the project is exempt from CEQA under section 15306.

This project does not involve impacts on any particularly sensitive environment; does not involve any cumulative impacts of successive projects of the same type in the same place that might be considered significant; does not involve unusual circumstances that might have a significant effect on the environment; will not result in damage to scenic resources within a highway officially designated as a state scenic highway; the project site is not included on any list compiled pursuant to Government Code section 65962.5; and the project will not cause a substantial adverse change in the significance of a historical resource. Therefore, none of the exceptions to categorical exemptions listed in CEQA Guidelines section 15300.2.

b) Agreement **IS NOT** exempt.

**IMPORTANT:** consult with the legal office to determine next steps.

Yes or No

If yes, answer yes or no to all that applies. If no, list all as “no” and “None” as “yes”.

Additional Documents	Applies
Initial Study	No
Negative Declaration	No
Mitigated Negative Declaration	No
Environmental Impact Report	No
Statement of Overriding Considerations	No
None	Yes

#### H. Is this project considered “Infrastructure”?

No

#### I. Subcontractors

List all Subcontractors listed in the Budget (s) (major and minor). Insert additional rows if needed. If no subcontractors to report, enter “No subcontractors to report” and “0” to funds.

**Delete** any unused rows from the table.

Subcontractor Legal Company Name	CEC Funds	Match Funds
TBD M&V Contractor	\$ 80,000	\$0
TBD - Installation Contractor	\$ 80,000	\$0

#### J. Vendors and Sellers for Equipment and Materials/Miscellaneous

List all Vendors and Sellers listed in Budget(s) for Equipment and Materials/Miscellaneous. Insert additional rows if needed. If no vendors or sellers to report, enter “No vendors or sellers to report” and “0” to funds. **Delete** any unused rows from the table.



Vendor/Seller Legal Company Name	CEC Funds	Match Funds
No vendors to report	\$	\$

### K. Key Partners

List all key partner(s). Insert additional rows if needed. If no key partners to report, enter "No key partners to report." **Delete** any unused rows from the table.

Key Partner Legal Company Name
No key partners to report

### L. Budget Information

Include all budget information. Insert additional rows if needed. If no budget information to report, enter "N/A" for "Not Applicable" and "0" to Amount. **Delete** any unused rows from the table.

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	23-24	301.00K	\$2,910,550

**TOTAL Amount:** \$ 2,910,550

R&D Program Area: ICMB: IAW

Explanation for "Other" selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

### M. Recipient's Contact Information

#### 3. Recipient's Administrator/Officer

Name: Cody Oliver

Address: 26225 Eden Landing Rd Ste D

City, State, Zip: Hayward, CA 94545-3718

Phone: 979-219 - 4853

E-Mail: c.oliver@nelumbo.io

#### 4. Recipient's Project Manager

Name: Michael Ung

Address: 26225 Eden Landing Rd Ste D

City, State, Zip: Hayward, CA 94545-3718

Phone: (714) 749-4609

E-Mail: m.ung@nelumbo.io

### N. Selection Process Used



There are three types of selection process. List the one used for this GRF.

Selection Process	Additional Information
Competitive Solicitation #	GFO-23-301
First Come First Served Solicitation #	Not applicable
Other	Not applicable

## O. Attached Items

1. List all items that should be attached to this GRF by entering "Yes" or "No".

Item Number	Item Name	Attached
1	Exhibit A, Scope of Work/Schedule	Yes
2	Exhibit B, Budget Detail	Yes
3	CEC 105, Questionnaire for Identifying Conflicts	Yes
4	Recipient Resolution	No
5	Awardee CEQA Documentation	No

### Approved By

Individuals who approve this form must enter their full name and approval date in the MS Word version.

**Agreement Manager:** Christian Fredericks

**Approval Date:** 7/5/2024

**Branch Manager:** Ilia Krupenich on behalf of Cody Taylor

**Approval Date:** 7/5/2024

**Director:** Ilia Krupenich on behalf of Cody Taylor on behalf of Director

**Approval Date:** 7/5/2024

**Exhibit A  
Scope of Work  
Nelumbo Inc.**

**I. TASK ACRONYM/TERM LISTS**

**A. Task List**

<b>Task #</b>	<b>CPR<sup>1</sup></b>	<b>Task Name</b>
1		General Project Tasks
2		Measurement and Verification of Existing Equipment Performance
3	X	Modification of Production Process & Equipment
4		Preparation & Installation of Ice-Nein™ Evaporator Coils
5	X	Measurement and Verification of Ice-Nein™ Performance
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

**B. Acronym/Term List**

<b>Acronym/Term</b>	<b>Meaning</b>
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
HGD	Hot Gas Defrost
M&V	Measurement and Verification
Material Specification	A proprietary list of physical characteristics and measurements used to confirm the production process behaved as intended. Comparing the output of each production batch to this specification is a portion of Nelumbo's quality control program.
Product Specification	A proprietary list of performance objectives. A series of qualitative and quantitative tests are performed on the production part and follow-on representative test coupons to confirm each batch has met our product specification.
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 a pilot demonstration and deployment of an advanced anti-ice coating for the decarbonization of industrial & commercial cold storage. The functional coating is an innovative inorganic ceramic that combines nano-structures and surface chemistry to manipulate condensation & frost to improve energy efficiency and enable load shifting.

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<sup>1</sup> 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**

### **Nelumbo Inc.**

#### **B. Problem/ Solution Statement**

##### **Problem**

Industrial refrigeration systems rely on refrigerant to air heat exchangers to create temperature controlled spaced. Ice continually forms on these evaporator coils because their surface is below the freezing point of water and will freeze moisture from the air forming frost. Frost formation diminishes the ability of the coil to cool the air by acting as a thermal barrier and by blocking the flow of air. Overtime frost diminishes system efficiency and can lead to inadequate cooling and system failure which necessitates the need to defrost. Defrost is an energy intensive process which accounts for up to 21% of the energy consumption of refrigerated systems through direct consumption of energy and the heat added into refrigerated space.<sup>2</sup>

The state-of-the-art solution for dealing with frost accumulation is periodic defrost cycles. Industrial refrigeration systems commonly use hot gas defrost (HGD) to melt the frost and restore evaporator capacity. HGD negatively impacts performance by causing periods of no cooling which increases cycle time and adds thermal load to the room thereby increasing refrigeration costs. Furthermore, the frequent and required HGD complicate the ability to conduct peak load management, impacting state wide peak power requirements.

##### **Solution**

The recipient has developed Ice-Nein™ surface modified coated evaporator coils to address the inefficiencies from frost formation and the need to defrost. To date there are no anti-ice coating products available for industrial & commercial heat exchangers. The surface modification will utilize an innovative advanced coating comprised of a nano-structured ceramic to overcome these barriers by (1) delaying the onset of frost formation, (2) slowing the rate of frost growth, and (3) enhancing the removal of frost. This will have an immediate impact on energy efficiency, but will also all enable improved load shifting by 1) allowing for more flexibility in defrost timing 2) improving pull down rate for improved sub-cooling 3) extending cycle times to beyond the peak hour durations.

#### **C. Goals and Objectives of the Agreement**

##### **Agreement Goals**

The goals of this Agreement are to:

- Reduce greenhouse gas emissions from the industrial refrigeration system by 25%
- Reduce energy consumption by of the industrial refrigeration system by 20%
- Reduce energy costs of the industrial refrigeration system by 30%

**Ratepayer Benefits:**<sup>3</sup> This Agreement will result in the ratepayer benefit of greater electricity reliability, lower costs, and increased safety by reducing demand, especially peak demand, reducing emissions, and by reducing the likelihood of harmful refrigerant leaks.

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<sup>2</sup> Becker Engineering Company, 2013. GreenGuide for Sustainable Energy Efficient Refrigerated Storage Facilities. California Energy Commission CEC-500-2013-145, Contract # PIR-08-011

<sup>3</sup> 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

## Exhibit A

### Scope of Work

#### Nelumbo Inc.

Technological Advancement and Breakthroughs:<sup>4</sup> 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 reducing demand and peak demand. California's Clean Energy and Pollution Reduction Act of 2015 (SB-350) requires the state to double energy efficiency by 2030. Industrial refrigeration is an energy intensive process which supports food and beverage producers, cold chain storage and logistics, agriculture, and pharmaceutical manufacturers. In California, these industrial sectors form the 3rd largest users of industrial electricity making them prime targets for efficiency improvements.

Funding this proposal will enable the commercialization of an advanced heat exchanger coating technology that increases energy savings in this sector by 20% which translates into 352 GWh/yr, and enhances grid stabilization for California ratepayers by reducing peak demand through the improved efficiency and flexibility.

#### **Agreement Objectives**

The objectives of this agreement are to:

- Demonstrate that this technology can achieve the stated goals in a full-scale pilot demonstration
- Build a data set to support rapid industry adoption of the technology to facilitate the state

### **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:**

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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](http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF)).

<sup>4</sup> 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.

## **Exhibit A Scope of Work Nelumbo Inc.**

### 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.

## Exhibit A Scope of Work Nelumbo Inc.

- 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

## **Exhibit A Scope of Work Nelumbo Inc.**

- 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.

## **Exhibit A Scope of Work Nelumbo Inc.**

- 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(s)
- 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:**

## **Exhibit A Scope of Work Nelumbo Inc.**

- 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**

## Exhibit A Scope of Work Nelumbo Inc.

### 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**)
    - 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)
- Submit a draft of the Executive Summary to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments on Draft Final Report* 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 on Draft Final Report
- 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.



## **Exhibit A**

### **Scope of Work**

#### **Nelumbo Inc.**

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.

## **Exhibit A**

### **Scope of Work**

#### **Nelumbo Inc.**

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).

## **Exhibit A Scope of Work Nelumbo Inc.**

### **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.

## **Exhibit A**

### **Scope of Work**

#### **Nelumbo Inc.**

#### **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.

## **Exhibit A**

### **Scope of Work**

#### **Nelumbo Inc.**

- 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 finalize key performance targets for the project based on feedback from the TAC and report on final results in achieving those targets. 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 project performance metrics section of the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.
- Present the draft project performance metrics 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 *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
  - TAC comments the Recipient does not propose to incorporate with and explanation why.
- 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 Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
- Discuss the *Project Performance Metrics Results* at the Final Meeting.

#### **Products:**

- TAC Performance Metrics Summary
- Project Performance Metrics Results

**Exhibit A**  
**Scope of Work**  
**Nelumbo Inc.**

### **III. TECHNICAL TASKS**

#### **TASK 2: MEASUREMENT AND VERIFICATION OF EXISTING EQUIPMENT PERFORMANCE**

The goal of this task is to quantify the performance of the existing refrigeration equipment to provide a baseline for comparison to the technology demonstration. Performance will be quantified in terms of absolute energy consumption as well as peak hour energy consumption. Additional supplemental data will also be gathered such as air and product temperature.

**The Recipient shall:**

- Coordinate with, and manage the activities of the Measurement & Verification (M&V) partner to achieve the following tasks:
  - Draft an initial Measurement & Verification Plan to quantify performance of the existing equipment. Minimum requirements are electrical power consumption at the building level and for each compressor circuit. Additionally, we will work with the M&V service provider to expand to energy consumption of individual evaporator units. This will require measuring refrigeration capacity, and add complexity outside of their normal expertise, however it would allow for more accurate extrapolation of results to other refrigeration facilities.
  - Install and validate required instrumentation for measurement
- Commission energy and refrigeration capacitance measuring equipment for compressors and individual evaporator units, and gather initial data to confirm the ability to measure energy consumption at the individual equipment and facility levels. Incorporate learnings from initial data to revise the initial Measurement & Verification Plan, then deliver a *Final Measurement & Verification Plan* to quantify performance of the existing equipment
  - It is expected that the measurement strategy may need to change from the initial M&V plan, particularly regarding refrigeration capacity measurements. Details of how to implement this measurement cannot be finalized until initial measurements are gathered.
- Prepare and deliver a *Post-Commissioning Report* that summarizes data resolution & quality, ensuring they are sufficient to proceed with the project.
  - Documents any deviation from initial Measurement & Verification Plan
  - If necessary, makes recommendations for any adjustments
- Monitor and analyze operational data continuously throughout the required 12 months of baselining
- Prepare a draft *Baseline Performance Summary Report*
  - Electrical power consumption (kWh): total, daily/weekly/monthly averages, total peak consumption, etc.
  - Average cooling capacity
  - Average energy cost
  - Total number of defrost cycles
- Submit the draft *Baseline Performance Summary Report* to the CAM for feedback
- Incorporate changes as requested and submit the final *Baseline Performance Summary Report*

**Products:**

- Final Measurement & Verification Plan

## **Exhibit A Scope of Work Nelumbo Inc.**

- Post-Commissioning Report (draft & final)
- Baseline Performance Summary Report (draft & final)

### **TASK 3: MODIFICATION OF PRODUCTION PROCESS & EQUIPMENT**

The goal of this task is to maintain coating quality and performance while adapting equipment and process to full industrial scale coils (specific size will vary per existing equipment).

#### **The Recipient shall:**

- Conduct a thorough survey of existing equipment at Daylight Foods
- Procure appropriate evaporator coils for scale up testing
- Modify production equipment at the recipient's HQ to accommodate project specific evaporators as determined by above survey. Modify equipment according to the facility's needs and project requirements, taking into consideration the following:
  - Tank size/geometry
  - Fluid distribution
  - Custom rigging for specific evaporator coil geometry and weight distribution during production processing
- Modify production process parameters, incorporating changes to the part size and geometry and the equipment modifications listed above to achieve the specific physical and chemical characteristics of the Ice-Nein™ product. Examples include possible changes to:
  - Process immersion times
  - Number of rinses / drying times
  - Changes to concentrations or bath life due to larger surface area
- Prepare and deliver a *Production Readiness Report* summarizing and quantifying our ability to produce the Ice-Nein™ material on full size industrial evaporator coils
- Prepare a *CPR Report 1* in accordance with subtask 1.3 (CPR Meetings)
- Participate in a CPR meeting

#### **Products:**

- Production Readiness Report (draft & final)
- CPR Report 1 (draft & final)

### **TASK 4: PREPARATION & INSTALLATION OF ICE-NEIN™ EVAPORATOR COILS**

The goal of this task is to prepare & install the Nelumbo coated evaporator coils into the cold storage facility.

#### **The Recipient shall:**

- Procure all required coils to retrofit the entire facility
- Process evaporator coils, applying the recipient's proprietary Ice-Nein™ coating
- Prepare & submit the *Quality Control Summary Report*. This will include:
  - Pictures & data confirming that each of the coated coils are in spec
  - Performance data of follow-on samples from each batch tested in Nelumbo's laboratory

## **Exhibit A Scope of Work Nelumbo Inc.**

- Data will be used to support correlations between existing lab data and pilot demonstration data to further supplement project data and promote widespread adoption
- Oversee the installation of the coated evaporator coils at the demonstration site (conducted by Daylight Foods preferred refrigeration vendors)

### **Products:**

- Quality Control Summary Report (draft & final)

### **TASK 5: MEASUREMENT AND VERIFICATION OF ICE-NEIN PERFORMANCE**

The goal of this task is to quantify the performance of the refrigeration equipment after retrofitting with the recipient's technology to compare to the baseline data from Task 2. Performance will be quantified in terms of absolute energy consumption as well as peak hour energy consumption. Additional supplemental data will also be gathered such as air and product temperature.

#### **The Recipient shall:**

- Monitor and analyze operational data continuously throughout the required 12 months of measurement & verification after installation of the coated coils.
- Prepare a draft *Ice-Nein™ Performance Summary Report* that compares pre-deployment & post-deployment performance across all metrics outlined in Task 2 and existing lab and pilot demonstration data outlined in Task 4 and submit it to the CAM for feedback
- Incorporate changes as requested and submit the final *Ice-Nein™ Performance Summary Report*
- Prepare a *CPR Report 2* in accordance with subtask 1.3 (CPR Meetings)
- Participate in a CPR meeting

### **Products:**

- Ice-Nein™ Performance Summary Report (draft & final)
- CPR Report 2 (draft & final)

### **TASK 6: EVALUATION OF PROJECT BENEFITS**

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

#### **The Recipient shall:**

- Complete the *Initial Project Benefits Questionnaire*. The Initial Project Benefits Questionnaire shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Complete the *Annual Survey* by January 31st of each year. The Annual Survey includes but is not limited to the following information:
  - Technology commercialization progress
  - New media and publications
  - Company growth
  - Follow-on funding and awards received



## **Exhibit A**

### **Scope of Work**

#### **Nelumbo Inc.**

- Complete the *Final Project Benefits Questionnaire*. The Final Project Benefits Questionnaire shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete and update the project profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.

#### **Products:**

- Initial Project Benefits Questionnaire
- Annual Survey(s)
- Final Project Benefits Questionnaire
- Documentation of Project Profile on EnergizeInnovation.fund
- Documentation of Organization Profile on EnergizeInnovation.fund

### **TASK 7 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES**

The goal of this task is to ensure the technological learning that resulted from the demonstration(s) is captured and disseminated to the range of professions that will be responsible for future deployments of this technology or similar technologies.

#### **The Recipient Shall:**

- Develop and submit a *Project Case Study Plan* that outlines how the Recipient will document the planning, construction, commissioning, and operation of the technology or system being demonstrated. The Project Case Study Plan should include:
  - An outline of the objectives, goals, and activities of the case study.
  - The organization that will be conducting the case study and the plan for conducting it.
  - A list of professions and practitioners involved in the technology's deployment.
  - Specific activities the recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
  - Presentations/webinars/training events to disseminate the results of the case study.
- Present the draft *Project Case Study Plan* to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the draft *Project Case Study Plan*. This document will identify:
  - TAC comments the recipient proposes to incorporate into the final *Technology Transfer Plan*.

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Nelumbo Inc.**

- TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit the final *Project Case Study Plan* to the CAM for approval.
- Execute the final Project Case Study Plan and develop and submit a Project Case Study.
- When directed by the CAM, develop presentation materials for a CEC sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California 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:**

- Project Case Study Plan (draft and final)
- Summary of TAC Comments
- Project Case Study (draft and final)
- High Quality Digital Photographs

**IV. PROJECT SCHEDULE**

Please see the attached Excel spreadsheet.