UNITED STATES ADVANCED BATTERY CONSORTIUM LLC

Development of Lithium Electrode Based Cell and Manufacturing for Automotive Traction Applications

REQUEST FOR PROPOSAL INFORMATION (RFPI)

April, 2020

FCA US LLC - FORD MOTOR COMPANY - GENERAL MOTORS

DEVELOPMENT OF LITHIUM ELECTRODE BASED CELL & MANUFACTURING FOR AUTOMOTIVE TRACTION APPLICATIONS

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1.0 Statement of Purpose/Objectives

The United States Advanced Battery Consortium LLC (USABC), an organization whose members are FCA US LLC, Ford Motor Company and, General Motors defines and conducts pre-competitive, vehicle-related research and development (R&D) in advanced battery technology. USABC has carried out a number of battery development programs, focusing on low-cost, long-life, high-energy, high-power technologies, including several programs in which the development of improved active materials was critical to the successful outcome of the program. The USABC, in recognition of the potential importance of lithium anodes to advanced battery systems, intends to further extend development of this critical component.

The purpose of this RFPI is to identify developers having lithium electrode technologies that have the capability of meeting the USABC goals for cell goals (Appendix A) and/or electrode goals (Appendix B). Respondents may either reply towards the cell goals, electrode goals or both. USABC seeks industrial-scale development consistent with intended high-volume automotive usage, supported by a detailed cost model for the cells and/or electrodes, respectively. The USABC expects that this work will be partially funded by the US Department of Energy (US DOE) through a cooperative agreement awarded to the USABC. The USABC is currently working under a cooperative agreement with the US DOE for the development of high performance batteries. The USABC has concluded that it is now appropriate to solicit proposals from active material developers who have the potential of meeting the criteria noted in the Appendix.

The USABC intends to capitalize on the knowledge it has gained through the HEV, PHEV, and EV research and development activities. We expect developers to bring past experiences and lessons learned from their high power and/or high-energy work to bear on developing energy storage cells and active materials.

2.0 Business Objectives

This USABC RFPI represents a unique opportunity for developers to leverage their resources in combination with those of the automotive industry and the federal government. For the auto makers, this type of pre-competitive cooperation minimizes duplication of effort and risk of failure, and maximizes the benefits to the public of the government funds.

Beyond the efficient and timely usage of resources, the auto makers recognize that successful commercialization of these technologies will only be completed when a supplier base has been established for the selected components and subsystems. It is, therefore, a major business objective of USABC to enhance a supplier base as the development progresses. All developers

submitting proposals will be requested to demonstrate that they have the potential to develop a commercially viable business, which can produce sufficient volumes to meet automotive requirements, and provide engineering and testing support to meet automotive implementation requirements. Research and other organizations with current, direct affiliations with businesses that derive a majority of their income from related product sales, will also be considered. At the time of submittal, all developers will be required to have demonstration samples and test results available for USABC inspection. Existing testing performed in accordance with the USABC battery test procedures is preferred, but not mandatory. Inspection and testing of samples by the USABC may be included in the selection process. Developers who do not have test results available for examination by USABC at the time of submittal need not respond. Proposals should be meaningfully different from other proposals previously offered to USABC. Evaluation of the materials in a full cell configuration will be required in respondents to Appendix A.

3.0 Developmental Timing

The proposals must be accompanied by a development time chart specifying the following:

1. Length of time the technology has been under development by the developer;
2. Projected length of time remaining to full scale availability; and
3. Projected time line for commercialization, including any preproduction phases that may be planned.

4.0 Business Case

The submittal must be accompanied by a business case, divided into two sections. The first section shall state the cost assumptions used that will lead to the cost targets listed in the Appendix. These assumptions should be in general terms, broken down by major components, including material cost, processing cost and other costs. These costs should be presented in sufficient detail such that they can be used by the USABC to build confidence that its cost targets can be met by the proposed technology.

The second portion of the business case should address the anticipated capital investment required to support this initial program investment, including anticipated non-vehicle markets for the technology, sources of capital, etc. A copy of the USABC cost model, which is a multi-stage spreadsheet, is available on the USABC website:
http://www.uscar.org/guest/article_view.php?articles_id=143.
Please note that USABC will not provide funding for capital expenses.

5.0 Technical Challenges

Proposals must be accompanied by a clear description of the remaining technical and other challenges that the developer still needs to meet in order to commercialize the proposed

technology and meet USABC's long-term criteria. A narration of the technical challenges that have already been met in order to reach the present state of development will also be useful. Any testing, by USABC, of pre-contract demonstration hardware will be done in accordance with the USABC battery test procedures. These procedures can be found on the USABC website, http://www.uscar.org/guest/article_view.php?articles_id=86.

6.0 Information Requested

The information USABC is requesting from interested parties is specified in the following subsections. It includes: (1) a brief description of your company(s) background; (2) a description of the lithium electrode technology (cell and/or electrode) being proposed and an associated cost model; (3) the development plan for the technology; (4) the proposed program deliverables (including cells to be tested in the case of Appendix A), timing, and cost-share; (5) any formal or informal teaming/partnership arrangements planned, and (6) confirmation of export control compliance. Note that the testing and technology demonstration of the novel active material technology must occur as described below in the Appendix. Relevant background information regarding USABC performance targets can be found on the USCAR website, at http://www.uscar.org/guest/teams/12/U-S-Advanced-Battery-Consortium-LLC .

USABC does not expect to award contracts on the sole basis of responses to this RFPI. All responses will be considered by representatives of the USABC members and other participants, and will be ranked according to their merit. The submitters of the most promising proposals will be contacted by USABC to enter into negotiations that may lead to firm contractual arrangements. If the government and other funding become available, as now expected, USABC intends to award one or more development contracts. However, nothing herein should be interpreted as a commitment to award a contract.

The information requested below should be answered as thoroughly as possible within a maximum of twenty-five pages, in total, for the response to the RFPI. Your submission package should be sent via electronic mail and shall contain a cover letter, a complete copy of your proposal, and a signed copy of the RFPI Agreement. If you have any questions concerning the RFPI, please contact Alvaro Masias (amasias@ford.com) or Maureen LaHote (313) 910-3720.

NOTWITHSTANDING PROPOSER'S MARKINGS TO THE CONTRARY, ALL INFORMATION SUBMITTED IN RESPONSE TO THIS USABC RFPI SHALL BE TREATED ON A NON-CONFIDENTIAL BASIS.

ALL PROPOSALS ARE TO BE SUBMITTED TO THE CONSORTIUM IN ACCORDANCE WITH THE ATTACHED RFPI AGREEMENT WHICH MUST BE EXECUTED WITHOUT MODIFICATION AND ACCOMPANY THE PROPOSAL. NO PROPOSAL SHALL BE EVALUATED BY THE CONSORTIUM WITHOUT PRIOR EXECUTION OF SUCH RFPI AGREEMENT.

SEND, VIA ELECTRONIC MAIL, YOUR PROPOSAL (including signed RFPI Agreement) TO:

Maureen LaHote
Business Manager
United States Advanced Battery Consortium
E-mail: mlahote@uscar.org

7.0 USABC Terms and Conditions are available on the USABC website. Please review all terms and conditions. Terms and Conditions can be found here: https://www.uscar.org/guest/teams/12/U-S-Advanced-Battery-Consortium

8.0 Proposal Template

8.1 Brief Company Background/Overview

- Company structure and ownership
- Relevant product lines
- Manufacturing and product locations
- Experience with commercialization of relevant product lines; in particular automotive OEMS
- Financial Summary
- Summary of total resources (including breakdown) allocated to relevant product lines over the last three years and forecasted for the project period

8.2 Technology Program Introduction

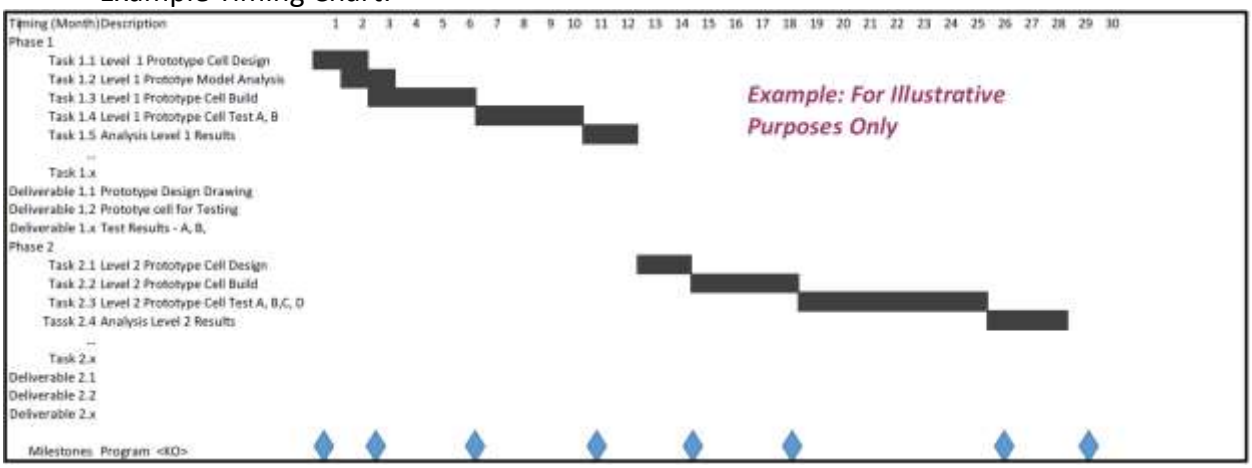
- Technology description and statement of project objective
- What distinguishes this from other technologies and/or approaches?
- Approximate length of program
- End of Program Objectives in relation to USABC Goals
    - Gap Analysis using Appendix A, B or both
- Technology Background
    - Current Technology Status including analysis and test results
        - Physical, safety, manufacturing, recycling, quality, etc.
    - Technical challenges
        - Challenges to be addressed during course of project work

8.3 Program Description

- Gap analysis comparing current state of technology with USABC targets (Appendix A and/or B)
- Identify which areas of the technology need development work
- Clearly state program goals and objectives and compare to USABC goals
- Provide Program Development Timeline
  - Identify main tasks and deliverables included in timeline, describe by key elements
  - Identify any sub-tasks that have been identified
  - Proposals toward Appendix A must plan on cell deliverables sufficient for automotive testing in year one (i.e. ≥18 cells and ≥2Ah with the format to be determined by developer) and a path toward large cells (i.e. ≥18 cells and ≥10Ah with the format to be determined by developer) by the final project year
- Provide a cost model for technology and plan to address cost gap, use USABC cost model provided here
  - http://www.uscar.org/guest/article_view.php?articles_id=143

8.4 Development Timing Plan

Example Timing Chart:



- List of Milestones — Timing (Months)
  - Program <KO> — Month 1
  - Design Complete — Month 4
  - . . .
  - . . .

8.5 Program Test Plan

Test Plan Pro-Forma/Example:

Tests	In-House Cell		National Lab – Cell		Other Facility	Comments
	10	40	10	40		
Nail Penetration	X	X	X	X		Must not exceed EUCAR4
Cycle Life 30°C	X	X	X	X		Meet goal
Test 3						Meet goal
Test 4						
Test 5						

Test Plan Note: If two or more systems are being developed, provide a test plan for each

8.6 Program Cost, Budget and Cost Sharing

- Proposed program budget including breakdown of labor, materials, indirect costs, spending rate over project period, etc. using EERE 335 Budget form (http://www.uscar.org/guest/article_view.php?articles_id=87)
- Provide separate budget analysis showing program costs allocated by task
- Describe proposed cost share (a minimum of 50 percent developer cost share is contractually required)
- Provide confirmation that at least 75% of the direct labor billed to USABC for this project will be incurred within the United States

8.7 Program Management

- Provide list of key personnel, in particular program manager, and % time allocated to the project
- Provide a brief resume of key personnel to be assigned to the project

8.8 Export Control Compliance

- The proposer will be required to acknowledge that export control rules limit or prohibit the transfer of covered technology to foreign nationals and agrees to establish and maintain internal controls and procedures adequate to insure accurate determination by the proposer of whether and when its technology falls within the ranges and definitions of the currently effective export control regime

RFPI AGREEMENT

NOTWITHSTANDING PROPOSER'S MARKINGS TO THE CONTRARY, ALL INFORMATION SUBMITTED IN RESPONSE TO A UNITED STATES ADVANCED BATTERY CONSORTIUM (USABC) REQUEST FOR PROPOSAL INFORMATION (RFPI) SHALL BE TREATED ON A NON-CONFIDENTIAL BASIS.

AGREED:

BY _____

TITLE _____

PROPOSER _____

DATE _____

APPENDIX A – Lithium Electrode Based Cell Goals

End of Life Characteristics at 30°C	Units	Goal
Peak Discharge Power Density, 30s Pulse	W/L	1600
Peak Specific Discharge Power , 30s Pulse	W/kg	800
Peak Specific Regen Power , 10 s Pulse	W/kg	300
Useable Energy Density @ C/3 Discharge	Wh/L	850
Useable Specific Energy @ C/3 Dis.	Wh/kg	450
Calendar Life	Years	10
DST Cycle Life*	Cycles	750
Cost @ 250K Vehicle units	$/kWh	50
Operating Environment	°C	-30 to +52
Normal Recharge Time	Hours	< 7h
High Rate Charge	Min	15 (80% Δ SOC)
Unassisted Operating at Low Temperature	%	>70% Use Energy @ C/3 Dis @-20 °C
Survival Temperature Range, 24 Hr	°C	-40 to+ 66
Maximum Self-discharge	%/month	< 1

*At 80% DOD and DST_{800} Power

APPENDIX B – Lithium Electrode Manufacturing Goals*

Value	Units	Goal
Thickness	um	<= 60
Cost	$/kg	33
Purity	%	99.9
Annual Production	m^2	6.8×10^8
Porosity	%	< 2

*Goals exclude current collector