

QUESTIONS AND ANSWERS

PLEASE REFER TO THE GENERAL FAQs SECTION OF ARPA-E'S WEBSITE ([HTTP://ARPA-E.ENERGY.GOV/?Q=FAQ/GENERAL-QUESTIONS](http://arpa-e.energy.gov/?q=faq/general-questions)) FOR ANSWERS TO MANY GENERAL QUESTIONS ABOUT ARPA-E AND ARPA-E'S FUNDING OPPORTUNITY ANNOUNCEMENTS. ADDITIONAL QUESTIONS SPECIFIC TO THIS FOA ONLY ARE INCLUDED BELOW. PLEASE REVIEW ALL EXISTING GENERAL FAQs AND FOA-SPECIFIC QUESTIONS BEFORE SUBMITTING NEW QUESTIONS TO ARPA-E.

I. Concept Paper Phase Questions:

Q1. CAN A SMALL COMPANY APPLY FOR AN SBIR (DE-FOA-0003419) AS WELL AS BE INCLUDED IN A TEAM APPLYING IN THE NON-SBIR CATEGORY (DE-FOA-0003419), MAKING CLEAR IN THE SUBMISSIONS OF THE OVERLAP AND UNDERSTANDING THAT IT CAN PARTICIPATE IN ONLY ONE AWARD?

ANSWER : Yes, you may apply as the Prime Recipient for NEWTON FOA DE-FOA-0003419 and be a Project Team member (not the Prime Recipient) on NEWTON FOA DE-FOA-0003418. Per Section III. C. 4 of the FOA, you cannot apply to both FOAs as the Prime Recipient; Small business Applicants that qualify as a "Small Business Concern" may apply to only one of the two ARPA-E NEWTON FOAs.: DE-FOA-0003419 (NEWTON SBIR/STTR), or DE-FOA-0003418 (NEWTON).

Q2. I AM EMAILING YOU REGARDING A CONCEPT PAPER SUBMISSION TO THE FOA ON THE NEWTON PROGRAM, AND I HAVE A QUESTION.

THE TEMPLATE SPECIFIES THAT IN THE CONCEPT SUMMARY SECTION, WE SHOULD "IDENTIFY THE SPECIFIC ISOTOPES, ELEMENTAL WASTE STREAMS, OR CLASS OF UNF ISOTOPES THE TECHNOLOGY WILL ADDRESS FROM TABLE 1 IN SECTION I.B OF THE FOA". HOWEVER, THE PROJECT THAT WE ARE PROPOSING IS A DEMONSTRATION OF ACCELERATOR RELIABILITY PARAMETERS AS LISTED TABLE 3. IT DOESN'T HAVE ANY BEARING ON THE SPECIFIC ISOTOPES IN TABLE 1 OF SECTION 1.B BECAUSE IT ONLY RELATES TO THE ACCELERATOR SIDE. DO WE STILL NEED TO DO ANYTHING FOR THIS SPECIFIC LANGUAGE OF IDENTIFYING ELEMENTS?

ANSWER: Language indicating that the proposed technology will broadly enable the transmutation of all classes of isotopes in Table 3 is sufficient.

Q3. COULD YOU PLEASE CLARIFY THREE THINGS:

- **IF WE APPLY FOR CATEGORY A (RELIABLE PARTICLE BEAM) AND CATEGORY B (TARGET MATERIAL OPTIMIZED FOR TRANSMUTATION), THEN WE CANNOT ALSO APPLY FOR CATEGORY C (ECONOMIC STUDY).**
- **EACH CONCEPT PAPER IS EXPECTED TO BE LESS THAN 4 PAGES, WHICH MEANS SUBMISSION FOR CATEGORY A WILL BE 4 PAGES, AND CATEGORY B WILL BE 4 PAGES, NOT 4 PAGES FOR BOTH TOGETHER.**
- **CAN YOU CONFIRM THAT THE TERM "TARGET" IN CATEGORY B DESCRIPTION RELATES TO THE FUEL AND NOT THE SPALLATION "TARGET" THAT PRODUCES NEUTRONS.**

ANSWER:

-Per section I. D of the FOA, Applicants can apply to Category A only, Category B only, a combination of Categories A and B, or Category C. The Concept Paper for the category you select must not exceed 4 pages in length including graphics, figures, and/or tables. Applicants submitting a single concept addressing both Categories A and B must not exceed 4 pages in length.

Per section III.C.4. of the FOA, Applicants may submit more than one application to this FOA, provided that each application is scientifically distinct.

Targets do relate to the fuel, or transmutable material, but improvements in spallation target technologies are also within scope for this program.

Q4. WE SEEK CLARIFICATION ON THE "COST" ROW IN TABLE 2 (SCREENSHOT BELOW) AS WE BELIEVE IT MAY BE REFERRING SPECIFICALLY TO "RF GENERATION DEVICES". NOTE THE "COST" ROW IN TABLE 4 (SCREENSHOT BELOW ALSO), WHICH IS EXCLUSIVELY FOR "RF GENERATION DEVICES", IS IDENTICAL TO THE "COST" ROW IN TABLE 2.

TABLE 2 IN ITS CURRENT FORM LEADS TO AN REASONABLE APPLICANT TO BELIEVE ONLY "RF GENERATION DEVICES" IS SOLICITED - BECAUSE "\$1/W" IS A INAPPROPRIATE PERFORMANCE OBJECTIVE FOR DEVICES LIKE "SUPERCONDUCTING RF CAVITIES, CRYOSYSTEMS, AND BEAM PORT WINDOWS", WHICH ARE SOLICITED AS WELL FOR CATEGORY A (FOA PAGE 10 SECTION D1). FOR APPLICANTS WHO INTEND TO SUBMIT A CONCEPT PAPER ON "SUPERCONDUCTING RF CAVITIES", THE "COST" ROW IN TABLE 2 MAY CREATE DIFFICULTY, HENCE BEGGING CLARIFICATION.

Table 2. Example desired performance objectives for Category A technologies.¹⁹

Parameter	State of the Art	Category A Objective
Beam Power	> 1 MW	> 10 MW
Beam Energy	> 0.5 GeV	> 1 GeV
Cost ²⁰	\$10/W	\$1/W
Availability ²¹	> 50%	> 90%

Table 3 suggests beam trip duration and magnitude limits for applications of transmutation facilities that may provide electricity to the grid, which would allow a transmutation system to be commercially viable as a power production facility.¹⁹

Table 3. Beam reliability parameters for a proton accelerator facility to meet program objectives.¹⁹

Parameter	State of the Art	Category A Objective
Beam Trips (t < 1 sec)	N/A	< 25,000/year
Beam Trips (1 < t < 10 sec)	< 2,500/year	< 2,500/year
Beam Trip (10 s < t < 5 min)	< 2,500/year	< 250/year
Beam Trips (t > 5 minutes)	< 50/year	< 3/year

Table 4 contains the desired performance objectives for a proposed technology area of RF generation devices. High wall plug efficiency solid-state RF devices enable the reliable and high availability particle generation sought by the NEWTON program. For other technology areas in particle generation, the information from Table 4 must also be included in the Concept Paper.

Table 4. Desired performance objectives for RF generation devices.

Parameter	State of the Art	Category A Objective
Wall plug efficiency	30%	50-70%
Cost	\$10/W	\$1/W
Energy per module ²²	50 kW	500 kW

ANSWER: The parameters in table 2 were given as an example for "RF generation devices." For other technologies that were labeled in scope for category A, such as "superconducting RF cavities" the table

should include a comparison to state-of-the-art parameters and the improvement your technologies would have. Not necessarily the exact parameters given in tables 2 and 4.

Q5. IN REVIEWING THE NEWTON FOA WE ARE WONDERING IF A COMPANY IS ONLY ALLOWED TO LEAD EITHER A CATEGORY A/B OR A CATEGORY C (BUT NOT BOTH)?

WITHIN THE NEWTON FOA - PAGE 13 OF THE PDF OR LABELED ON THE DOCUMENT AS PAGE 9 – WE NOTICED THE SPECIFICITY OF A ONLY, B ONLY, A COMBO OF A&B, OR C (SCREENSHOT BELOW).

Applicants can apply to Category A only, Category B only, a combination of Categories A and B, or Category C only, based on their expertise. Category C capabilities teams will perform TEA and life-cycle assessment (LCA) of a transmutation facility that incorporates the breakthrough technologies developed in Categories A and B. Applicants on Category A and B teams will be required to share performance data with Category C teams to inform the construction of the materials database, TEA and LCA, and facility co-design. Performance data will include the following information: power consumption, power output, frequency, wall plug efficiency, radiation tolerance, physical stability, throughput, etc. Category C capabilities teams will support analysis and facilitate communication between Category A and B teams and government and commercial partners. Any of the above sharing of data shall be subject to the requirements set forth below under Section I.D.3 that apply to such data sharing.

COULD YOU PLEASE CLARIFY IF THE SPECIFICITY ABOVE REQUIRES COMPANIES TO SELECT ONLY ONE AREA OR IF THE FAO GUIDANCE IS PER SUBMISSION?

ANSWER: The guidance is per submission. Per section III.C.4. of the FOA, Applicants may submit more than one application to this FOA, provided that each application is scientifically distinct.

Q6. *REDACTED*****

CATEGORY A INCLUDES DEVELOPMENT OF PARTICLE GENERATION SYSTEMS TO IMPROVE RELIABILITY AND ENERGY EFFICIENCY. A COUPLE OF QUESTIONS ON WHAT TOPICS WOULD BE VIABLE FOR THIS:

- 1. CAN WE USE (PART OF) THE MONEY FOR LASER ACCELERATOR DEVELOPMENT? WE WOULD PROPOSE LASER WAKEFIELD ACCELERATED ELECTRON BEAMS TO PRODUCE SECONDARY PHOTON AND/OR NEUTRON BEAMS WITH REASONABLE LASER-TO-PARTICLE CONVERSION EFFICIENCY AND HIGH DUTY CYCLE. AN IMPORTANT COMPONENT IN THE TOTAL EFFICIENCY FACTOR IS THE LASER WALL-PLUG EFFICIENCY ***REDACTED***. THE CATCH IS THAT NEED TO BUILD DEMONSTRATION LASER + ACCELERATOR SYSTEMS; TRANSMUTATION WOULD BE AN EXCELLENT USE CASE.**
- 2. CAN WE INCLUDE INVESTIGATION OF DECAY/TRANSMUTATION PATHWAYS BEYOND THOSE MENTIONED? OUR LASER-DRIVEN ACCELERATORS CAN UNIQUELY PROVIDE ULTRA-SHORT PULSES OF NEUTRON AND PHOTONS AND ARE COMPACT ENOUGH TO DELIVER COORDINATED DOSES OF NEUTRONS AND PHOTONS. THIS CAPABILITY LIKELY OPENS NEW DECAY PATHWAYS BY BEING ABLE TO PUMP THE NUCLIDES INTO EXCITED STATES BEFORE INDUCING DECAY, BUT THE RELEVANT NUCLEAR DATA IS ALMOST NON-EXISTENT AND REQUIRES SOME STUDY.**

OR IS ONE OR BOTH OF THESE MORE APPROPRIATELY DIRECTED TO THE CURIE PROGRAM?

ANSWER: Both of these technologies are within scope of the NEWTON FOA. The ARPA-E CURIE program is closed to application submissions.

Q7. I HAVE A QUICK QUESTION ABOUT THE NEWTON FOA.

MAY AN APPLICANT SUBMIT AN APPLICATION THAT SPANS ALL THREE OF CATEGORY A, B, AND C TOGETHER?

ANSWER: No. Category C applications must be completely separate from any application that includes Categories A or B. Please refer to NEWTON FOA Section I.D.

Q8. MY QUESTION RELATES TO THE RESPONSIVENESS OF A PROJECT SCOPE THAT WOULD INCLUDE THE FOLLOWING:

- DESIGN AND ENGINEERING (SPECIFICALLY MODIFICATIONS TO A PYRO OR PUREX FLOWSHEET) OF A UNF RECYCLING PROCESS THAT CAN YIELD TRANSMUTATION TARGETS FOR FAST-SPECTRUM FISSION REACTORS (MINOR ACTINIDES & SOME FISSION PRODUCTS IN FUEL) AND SPACE PROPULSION CONCEPTS REQUIRING ISOTOPES LIKE SR-90.

THE RATIONALE FOR THIS QUESTION IS THAT FISSION-BASED TRANSMUTATION IS ONLY MENTIONED IN THE INTRODUCTION AND NOT IN THE BODY OF TEXT COVERING CATEGORIES A-C.

ANSWER: Targets that would only be used in fast-spectrum fission reactors are not of interest to this FOA. Targets for use in space propulsion concepts are not of interest to this FOA.

Q9. WOULD YOU TAKE A LOOK AT FIGURE 2 ON PAGE 7 OF THE NEWTON_CP_FOA.PDF? IT LISTS PR-144 AS CONTRIBUTING 5% OF THE >5 YEAR DECAY HEAT. PR-144 HAS A HALF LIFE OF ~17 MIN. AFTER 5 YEARS, IT SEEMS THAT THE AMOUNT OF PR-144 WOULD BE VERY SMALL. I SUSPECT THAT SOME OTHER ISOTOPE WAS MEANT FOR THAT SLOT.

ANSWER: The information listed in Figure 2 is accurate. Please see cited reference

Q10. FOR CATEGORY B PROPOSALS, DO TEAMS NEED TO DEMONSTRATE TRANSMUTATION OF NOVEL TARGETS IN AN EXPERIMENT WITHIN ACTUAL REACTORS? THE SENTENCE IN THE FOA REPRODUCED BELOW SEEMS TO SUGGEST THAT EXPERIMENTAL TRANSMUTATION IS NOT NECESSARY. IS SIMULATED TRANSMUTATION SUFFICIENT TO BE RESPONSIVE?

"THE PERFORMANCE OF TARGETS MAY BE VALIDATED USING ACCEPTED MODELING SOFTWARE SUITES OR CODES"

ANSWER: No. Experimental transmutation is not required, simulated transmutation is sufficient for responsiveness.

Q11. DEAR CONTRACTING OFFICER, FOR THE ARPA-E NEWTON FOA, CATEGORY B, "TRANSMUTATION TARGETS," WOULD IT BE ACCEPTABLE TO USE A REACTOR TO DEMONSTRATE TARGET PERFORMANCE THAT WOULD BE TRANSLATED TO AN ACCELERATOR LATER ON, OR IS THERE A REQUIREMENT TO USE AN ACCELERATOR FACILITY?

ANSWER: Yes, a reactor is acceptable to demonstrate target performance if the results can be translated to an accelerator.