



U.S. Department of Energy

Categorical Exclusion Determination Form

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Project Title: 25A1988 - Sustainable, High-Energy Density, Low-Cost Electrochemical Energy Storage - Metal-Air Ionic Liquid (MAIL)

Location: Arizona

Proposed Action or Project Description:

American Recovery and Reinvestment Act:

We propose a potentially game-changing metal-air battery research and development program that will result in transformative advances in energy density, cycle life, sustainability, and cost. Metal-air cells have the potential to marry the ultra-high anode capacity (~1,000-2,000 Ah/kg) of pure metals with the air-breathing cathode of fuel cells (i.e. no oxidant storage). We will develop new battery chemistries based on rechargeable metal-air cathodes, metallic anodes and ionic liquid electrolytes that will revolutionize rechargeable energy storage. It may be possible in some of these Metal-Air Ionic Liquid (MAIL) cells to achieve energy densities in excess of 3000 Wh/kg. The possibility of making a primary cell at this energy density is transformative; a secondary cell at this energy density would change the world. We envision a tightly knit university-industry collaboration: generating jobs now, producing PhDs in renewable energy for the future, and enhancing the rate of return of the ARPA-E investment. This program will uniquely integrate physical electrochemists in academia and engineers with years of experience optimizing metal-air cells in industry. The goal is to aggressively evolve the science that enables development of MAIL batteries¹ and to expeditiously translate that science to engineers and a pilot-scale production facility for process engineering and product development. While this program is early-stage, ~~our vision is to co-develop the science with the practical engineering to fast-track translation to commercial viability. The high level goals of this~~

Categorical Exclusion(s) Applied:

X - B3.6 Siting/construction/operation/decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects

*-For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, see Subpart D of 10 CFR10 21 [Click Here](#)

This action would not: threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, including DOE and/or Executive Orders; require siting, construction, or major expansion of waste storage, disposal, recovery, or treatment facilities, but may include such categorically excluded facilities; disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; or adversely affect environmentally sensitive resources (including but not limited to those listed in paragraph B.(4)) of Appendix B to Subpart D of 10 CFR 1021). Furthermore, there are no extraordinary circumstances related to this action that may affect the significance of the environmental effects of the action; this action is not "connected" to other actions with potentially significant impacts, is not related to other proposed actions with cumulatively significant impacts, and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211.

Based on my review of information conveyed to me and in my possession (or attached) concerning the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: /s/ William J. Bierbower

Digitally signed by William J. Bierbower
 DN: cn=William J. Bierbower, o, ou,
 email=william.bierbower@hq.doe.gov, c=US
 Date: 2009.12.16 11:39:21 -05'00'

Date Determined: Dec 16, 2009

Comments:

Webmaster:



25A1988 - Proposed Action or Project Description (Continued)

our vision is to co-develop the science with the practical engineering to fast-track translation to commercial viability. The high level goals of this program are to create a measurably viable, highly safe, earthabundant and geo-politically sustainable, low cost technology. The safety attribute is especially important for transportation-based applications where large energies are stored under aggressive conditions. MAIL batteries will have unparalleled safety because, unlike traditional batteries that have energy densities comparable to the explosive charges in munitions, they do not store both oxidant and reductant in the same space. Thus, the runaway reactions that can drive rapid and catastrophic energy release from traditional batteries are not possible in MAIL cells. The transformational nature of this program extends beyond safety and energy density. By developing a battery chemistry from the outset with a focus on sustainability and domestic interests, we have the potential to make transportation both cost effective and to break the cycle of geopolitical liability with respect to fossil fuels and (on the horizon) non-domestic and narrowly located Li-reserves. Additionally, the cost and environmental impact metrics of current energy storage technologies are the dominant reasons that large-scale renewable installations have not adopted storage to firm those resources. Concomitantly, renewables are inherently intermittent sources of energy, substantially limiting the ability to grid-connect large installations and the penetration of renewables as a major energy contributor. When the technical attributes of the MAIL battery are combined with the cost projections and energy security attributes it is clear that this program has the potential to transform energy storage.