2014 ARPA-E Energy Innovation Summit

Showcase Submission Information Template

Use this template to prepare your answers for the online Technology Showcase Submission Form. Required fields are identified below with a red asterisk. (*)

Important!
If you are an **ARPA-E awardee directly receiving funding from ARPA-E**, you will be invited to participate, please do **NOT** complete the online application. You will receive an email from the Technology Forums team including your ARPA-E project control number. If you are a subcontractor or prior ARPA-E Awardee, you may complete the application.

Primary Applicant Information

(You will be prompted to enter the information in title case (uppercase and lowercase))

- First: Name: Robert
- Last name: Westervelt
- Suffix: Mr.
- Rank/Title: Technology Transfer Officer
- Organization: Sandia National Laboratories
- Division/Branch: Business Development and IP Management
- Job Title: Technology Transfer Officer
- Address: PO Box 5800, Albuquerque, NM, 87185
- Country: United States
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Submission Details

- Title: The Sandia Cooler

Additional Details

- *Select Category
  - Lead Awardee (STOP – do not complete this application)
  - ARPA-E Awardee Subcontractor
  - ARPA-E Alumni
  - ***None of the above***

- *Technology Summary: Describe the technology you are developing and how it works. (200 word max)

The Sandia Cooler represents a fundamental breakthrough in air cooled heat exchanger technology. Conventional forced convection heat exchangers use a fan to direct a stream of air onto the fins stationary aluminum or copper heat exchanger. In the Sandia Cooler, the heat load (e.g. from a CPU) is efficiently transferred from the stationary frame to the rotating frame through a hydrodynamic air bearing, to a rotating structure that is a hybrid of a finned heat sink and a centrifugal impeller. Transferring the heat to the rotating frame confers four important advantages: 1) the boundary layer of motionless air that normally envelopes the fins of the heat exchanger is significantly reduced in the accelerating frame, 2) much higher fin/air relative velocities can be achieved for a given amount of motor power consumption, 3) the geometry of the heat-sink-impeller may easily be chosen to minimize disturbance of the flow field, resulting in very quiet operation, and 4) high speed rotation of the finned heat sink greatly reduces dust fouling.

- *Transformational Merit: What is transformational about this technology? How is it different from existing technologies? (200 word max)

The Sandia Cooler provides a 5 to 10X improvement in cooling power per unit volume. In the case of CPU/GPU technology, this will allow processor clock speeds to be doubled in a wide variety of practical applications. But it is in the energy sector where this paradigm shift in heat transfer is expected to have the largest ramifications. Sandia is currently working on prototype devices to improve the efficiency of HVAC and refrigeration systems, and to solve the longstanding problem of thermal management in LED lighting. This technology is expected to be transformational because the Sandia Cooler R&D team has strongly emphasized the need to pursue only device architectures and problem solving strategies that are fully consistent with low-cost, high-volume production.

- *Next Steps: List technical challenges, developmental milestones, and/or other next steps needed to get this technology into the market. (200 word max)

The Sandia Cooler is now at TRL level 5 and is suitable for markets such as CPU/GPU cooling, IBGT array thermal management, etc. Device architectures for applications such as HVAC, refrigeration, and solid state lighting are currently TRL 2/3. A mature TRL 5 prototype white light LED luminaire is scheduled for completion by September 2014. A small scale (4 kW) prototype heat pump is currently under construction to provide a proof-of-concept demonstration of the application of this new heat exchanger technology to building HVAC applications.

- *Public Summary: Please provide a Technology Summary to be published on the conference website and in the printed program guide. (100 word max)

The Sandia Cooler represents a fundamental breakthrough in air cooled heat exchanger technology. Conventional forced convection heat exchangers use a fan to direct a stream of air onto the fins stationary aluminum or copper heat exchanger. In the Sandia Cooler, the heat load (e.g. from a CPU) is efficiently transferred from the stationary frame to the rotating frame through a hydrodynamic air bearing, to a rotating structure that is a hybrid of a finned heat sink and a centrifugal impeller. The cooling performance of this radically new heat exchanger architecture far exceeds that of the prior art.

- *Developmental Status (Choose one from drop-down menu)
  - Technology Prototype
  - Proof of Concept
  - **Product Prototype**
  - Pilot-Scale Prototype
  - Full-Scale Prototype
- *Application Area: (Choose one from drop-down menu)
  - Advance Fuels
  - Advanced Magnets
  - **Building Efficiency**
  - Carbon Capture Utilization
  - Control Systems
  - Electricity Transmission & Distribution
  - Energy Storage, Portable
  - Energy Storage, Stationary
  - **Industrial Efficiency**
  - Renewable Power Generation
  - Thermal Energy Utilization
  - Traditional Power Generation
  - Vehicle Technologies
  - Water
  - Other
    - If other – please state area
- Website URL
- Organization Size (Choose one from drop-down menu)
  - 1-15
  - 16-99
  - 100-499
  - 500-2499
  - **2500+**
- *Have you participated in the Showcase before? **Yes** or No
- If yes, what years did you participate? **2011**
- From who did you hear about this opportunity? (Choose one from drop-down menu)
  - Other Organization
  - ACCT Canada
  - Advanced Energy Economy (AEE)
  - American Council on Renewable Energy (ACORE)
  - American Energy Innovation Council
  - American Public Power Association

- ARPA-E Promotion (email, business card, etc.)
- **ARPA-E Program Director**
- Biotechnology Industry Association (BIO)
- CALSTART
- Center for Science Policy and Outcomes
- Chambers for Innovation and Clean Energy (CICE)
- Clean Edge
- Clean Energy Trust
- Cleantech Open
- Collegiate Energy Association
- Colorado Cleantech Industry Association
- DEED
- Earth Techling
- Electricity Storage Association (ESA)
- Environmental Entrepreneurs (E2)
- Fuel Cell and Hydrogen Energy Association
- GUIRR
- Gas Turbine Association
- Government Executive Media Group
- GreenTech Media
- IEE
- Information Technology and Innovation Foundation (ITIF)
- International Green Energy Council
- Licensing Executives Society
- MIT Technology Review
- NVCA
- National Hydropower Association
- New England Clean Energy Council
- N/A
- Northeast Sustainable Energy Association (NESEA)
- Pike Research
- Prescience International's Environmental Business Cluster (EBC)
- Scientific American
- U.S. Energy Association (USEA)
- UIDP

- Booth Features (Check all that apply)
  - **Live Demo**
  - Oversized or Special Items that Might Require Accommodation
  - **Prototype**
  - Video

- Slideshow
- **Posters**
- Banners or Large Signage
- Other
- No Information at this Time

- *Keyword: Enter a number of keywords separated by commas that will help attendees find your organization and technology.

heat transfer, cooling, heat exchanger, thermal management, HVAC, refrigeration, solid state lighting, LED lighting