Agreement between California Energy Commission and CO2Nexus Inc.

Title: Supercritical CO2 Cleaning and Sterilization of Commercial / Industrial Textile
Amount: $396,200.00
Term: 29 months
PIER Contact: Anish Gautam
RD&D Committee: 12/3/2009

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Electric	IAW	Energy Efficiency	$2,000,000	$200	$233,012	11%
09	Natural Gas	IAW	Natural Gas Efficiency RD&D for Industrial & Institutional Use	$1,400,000	$396,000	$400,000	28%

For the 2009 fiscal year, the total Electric budget is $62.5 million. Within the Electric program, the IAW program area budget is $2.75 million and, from this amount, $2 million was allocated to the Energy Efficiency budget initiative. If approved, the remaining initiative balance will be $233,012.

For the 2009 fiscal year, the total Natural Gas budget is $24 million. Within the Natural Gas program, the IAW program area budget is $1.8 million and, from this amount, $1.4 million was allocated to the Natural Gas Efficiency RD&D for Industrial & Institutional Use budget initiative. If approved, the remaining initiative balance will be $400,000.

Recommendation

Approve this agreement with CO2Nexus Inc. for $396,200.00, with $200,000 in match funding. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

The Problem

Commercial / industrial laundry has long been one of the major water consumers and uses billions of gallons of potable water each year. While the industry has implemented water efficiency measures thus far there have been no outright substitute solvents introduced which offer environmental, performance and cost benefits over water. The environmental impacts of implementing technology which does not utilize water as a cleaning solvent are enormous. CO2Nexus has developed a commercial prototype supercritical carbon dioxide-based laundry system for industrial/commercial laundry facilities that will reduce water consumption and significantly reduce energy usage through the elimination of the associated dryers. In order for market acceptance, the technical and commercial feasibility of a supercritical-carbon dioxide textile cleaning and disinfection machine must be demonstrated with independent verification of the energy and water savings.

Proposed Research

This project aims build the first commercial supercritical-carbon dioxide textile cleaning machine to document and validate:

- Real world cleaning performance across different industrial/commercial textiles, fabrics and surfactant formulations;
- Machine operating specifications including utilities (e.g. energy) consumption; cycle time; operability and workflow; component reliability; sterilization/disinfecting capabilities;
- Benchmarking of all relevant performance/cost criteria vs. incumbent water.

For this project, Southern California Gas Co. has agreed to provide the measurement and verification of natural gas savings, while the Los Angeles Dept. of Water and Power has agreed to provide measurement and verification of water saving.The demonstration site will be the U.S. Veterans Administrations main laundry facility for Southern California in Westwood (Los Angeles). This facility serves all VA hospitals from L.A. to San Diego. While this project will focus on deploying the technology in a hospital setting, a wide variety of end users stand to also benefit, including but certainly not limited to: industrial laundries, industrial textile cleaning, prisons, nursing homes, universities and hotels. California has approximately 8800 such facilities, this technology has the potential of saving 264 GWh (5% market penetration).

Research Justification and Goals

This project "[will develop, and help bring to market] increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers" (Public Resources Code 25620.1.(b)(2)), (Chapter 512, Statues of 2006)); and supports California's goal to assess efficiency improvements in hot and cold water use in homes and businesses, water saving appliances and fixtures, devices that use and move water, and other viable options to maximize energy and water savings per the Integrated Energy Policy Report 2005 by:

- Design and build a commercial scale supercritical CO2 textile cleaning / sterilization machine
- Measure and validate the technical cleaning (including sterilization) and economical performance of this machine. This includes cleaning performance, cycle time, workflow efficiency, energy and water consumption, and overall machine operation and reliability.
- Determine the real world operation, energy and water savings, and cost comparisons between water based and carbon dioxide based textile cleaning in an industrial setting.

This project also addresses The research areas promise to meet energy efficiency and environmental attributes and goals as set out in the Integrated Energy Policy Report (IEPR), the Warren-Alquist Act., Executive Order S-3-05 and AB 32. This solicitation also supports California's goals to expand efforts to improve public awareness and adoption of energy efficiency measures per the Energy Action Plan by early adoption of efficient technologies that will benefit California industry and providing a competitive advantage due to lower energy costs. These proposed awards support the general goal of SB 1250 (Perata, Chapter 512, Statutes of 2006), which states, in part, "the Public Interest Research, Development, and Demonstration Program is to develop, and help bring to market, energy technologies that provide increased environmental benefits, greater system reliability, and lower system cost, and that provide tangible benefits to electric utility customers.

Background

The proposal was submitted through competitive solicitation, Emerging Technology Demonstrations Grants Program Opportunity Notice 08-006. This opportunity notice was structured to solicit proposals under four categories 1) Data Center, 2) Energy Storage, 3)Industrial Energy Efficiency and 4) Water and Wastewater. This proposal was ranked 6 out of 12 proposals received through the solicitation under the Water and Wastewater category.

CO_2Nexus, Inc. has developed a commercial prototype of a supercritical-carbon dioxide (CO_2) based textile cleaning machine that has undergone initial testing at a pilot plant in Delft (The Netherlands) that has proven the process to be reliable, safe and cost-effective. This project will build on the initial pilot study to build the first commercial supercritical CO_2 textile cleaning machine to demonstrate in a real world environment, the cleaning and disinfection performance, energy and water savings, along with real world operational cost compared to water based textile cleaning machines.

Current retail processes of CO_2 textile cleaning use liquid phase CO_2, which may not have sufficient solvency for more demanding commercial and industrial cleaning applications. For these applications a machine using supercritical (higher pressure & temperature) carbon dioxide is required. High pressure and temperature CO2 (liquid/supercritical state) allows for a fluid state that can act as a washing fluid, has low viscosity and surface tension resulting in small pore penetration resulting in better cleaning action. In addition, after the cleaning process the pressure and temperature can be adjusted to have the CO_2 go from a supercritical state to pure gaseous state at which point the CO2 can be recaptured for reuse in the next cycle, the process allows for the reduction/elimination of the drying cycle that is commonly found in water based textile cleaning machines.

Therefore, the advantages for the use of supercritical CO_2 as a replacement for water based textile cleaning is a significant reduction in potable water use onsite, the reduce/elimination for the need to dry textiles (electric or natural drying process) and the reduction/elimination of the used laundry water waste stream that goes to the local wastewater treatment plant.

The proposed demonstration will validate and document the commercial feasibility of cleaning textiles more commonly found in industrial and commercial sites that today use significant amounts of water and energy, and produce a costly secondary waste stream all with an anticipated payback period of less than 3.5 years with no incentives.