Gmail glen2ns <glen2ns@gmail.com>

Desalination Projects to deliver LCOW $0.50/cubic meter: $616 acre foot

glen2ns <glen2ns@gmail.com> Fri, Jul 13, 2018 at 9:13 AM
To: dbilodeau@ocwd.com

Dear Director Bilodeau,
Please find attached recent information from the US Department of Energy seeking to help research laboratories develop technologies to achieve a levelized cost of water of 50 cents per cubic meter.

No doubt, as industry professionals, you are familiar with some aspects of this information. I thought to forward this to your attention with respect to the upcoming decision you will be making that could on one hand deliver an abundance of water to parties seeking to provide water to families and businesses new to the area. My understanding, from having attended board meetings for a year or two now, is that our GWRS (now expanding to 120MGD!!) has been covering the needs of your constituents and will do so according to projections.

On the other hand, the cost of this water, reported in a San Diego article titled: Desalination's Future in California is Clouded by Cost and Controversy is $2,300/acre foot at the Carlsbad site. The manufacturing and processing cost trajectory of this water seems to be steadily upward. Maybe if built in the next 3 years the cost would exceed $2,700/acre foot.

This project using reverse osmosis has little room for cost reductions as the technology, I've learned, is so fine tuned already. One could offset the $50 million/year for electricity to operate the site with renewable energy. My team of solar professionals declared a system sized at 90MW, costing about $150 million CAPEX and needing about 500 acres to site the technology would fulfill Gavin Newsom's call for a pristine GHG footprint at the State Lands Commission meeting last year.

With technology's track record of bring costs down and the US Department of Energy already writing $21 million in checks to 14 technology leaders, to deliver LCOW at $600/acre foot, it seems to me that the existing proposal is too costly for water that we actually don't need in the foreseeable future. Perhaps, these innovations could produce these achievements and commercial versions could become available in the next five years that will serve needs as we understand them.

But for now, please vote no.

As a concerned resident who otherwise is so very proud of OCWD, this proposal does not serve the needs of families and businesses and approving this would be profitable for the few but an injustice for your constituents in IMHO.

Thank you for considering my thoughts and resources.

Link to DOE site for more information on these 14 projects
https://www.energy.gov/eere/office-energy-efficiency-renewable-energy

Kindest regards,

Glenn Brooks
92646
(714) 478-1053

7-13-18 DOE $21M Low Energy Cost Solar Desalination Technologies.pdf
52K

Department of Energy

Department of Energy Announces $21 Million to Advance Solar Desalination Technologies

JUNE 19, 2018

WASHINGTON, D.C. – Today, the U.S. Department of Energy (DOE) announced $21 million for new projects to advance solar-thermal desalination technologies. These 14 projects are focused on reducing the cost of solar-thermal desalination and helping the technology to reach new markets, including to areas that are not connected to the electric grid.

Desalination treats seawater, brackish water, and contaminated water for use in municipal and industrial water supplies, or to serve other reclamation needs. Today's desalination operations need to be grid-connected, limiting their applications to areas with electricity access. Solar-thermal power, which concentrates sunlight and converts it into heat, has the potential to expand access to desalination by enabling smaller, more portable systems that don't have to be grid-connected.

Four markets that are particularly attractive for solar desalination technologies include: municipal water production, agriculture, industrial processes, and the

purification of water produced from energy development, including oil and gas extraction.

Projects that address challenges for small-scale plants that process low-volume, high-salinity water, like brine from oil and gas operations, target a levelized cost of water (LCOW) of $1.50 per cubic meter. Projects that address challenges for large-scale plants that process high-volume, low-salinity water, like sea water for a municipal utility, are expected to target an LCOW of $0.50 per cubic meter.

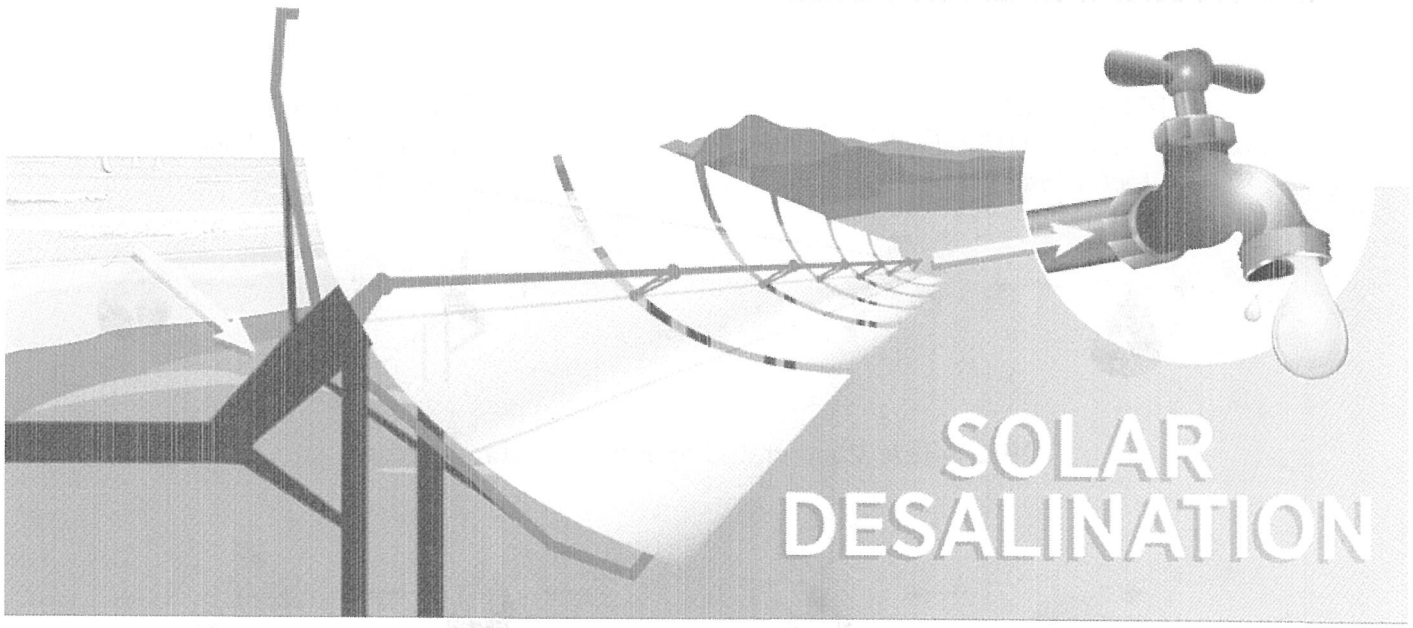
The awardees represent industry, laboratory, and university researchers:

- **Advanced Cooling Technologies, Inc. (Lancaster, Pennsylvania): $1.5 million**
- **Columbia University (New York, NY) $1 million**
- **Fraunhofer USA Center for Energy Innovation (Storrs, Connecticut): $800,000**
- **GreenBlu (Hamilton, New Jersey): $1.6 million**
- **Lawrence Berkeley National Laboratory (Berkeley, California): $800,000**
- **Natural Energy Laboratory of Hawaii Authority (Kailua-Kona, Hawaii): $2 million**
- **Oregon State University (Bend, Oregon): $2 million**
- **University of California: Los Angeles (Los Angeles, California): $2 million**
- **University of California: Merced (Merced, California): $1.1 million**
- **University of Illinois at Urbana-Champaign (Urbana, Illinois): $1.6 million**
- **University of North Dakota (Grand Forks, North Dakota): $2 million**
- **Rice University (Houston, Texas) $1.7 million**
- **SkyFuel, Inc (Lakewood, Colorado): $1.6 million**
- **Sunvapor, Inc. (Livermore, California): $1.5 million**

The projects are anticipated to last up to three years and will be awarded as cooperative agreements, which requires between 20 to 50 percent cost share. Cost share requirements ensure maximum return on taxpayer-funded research and development. In total, the projects represent a public-private investment of nearly $30 million.

Learn more about the DOE's Office of Energy Efficiency and Renewable Energy HERE.

Solar Desalination

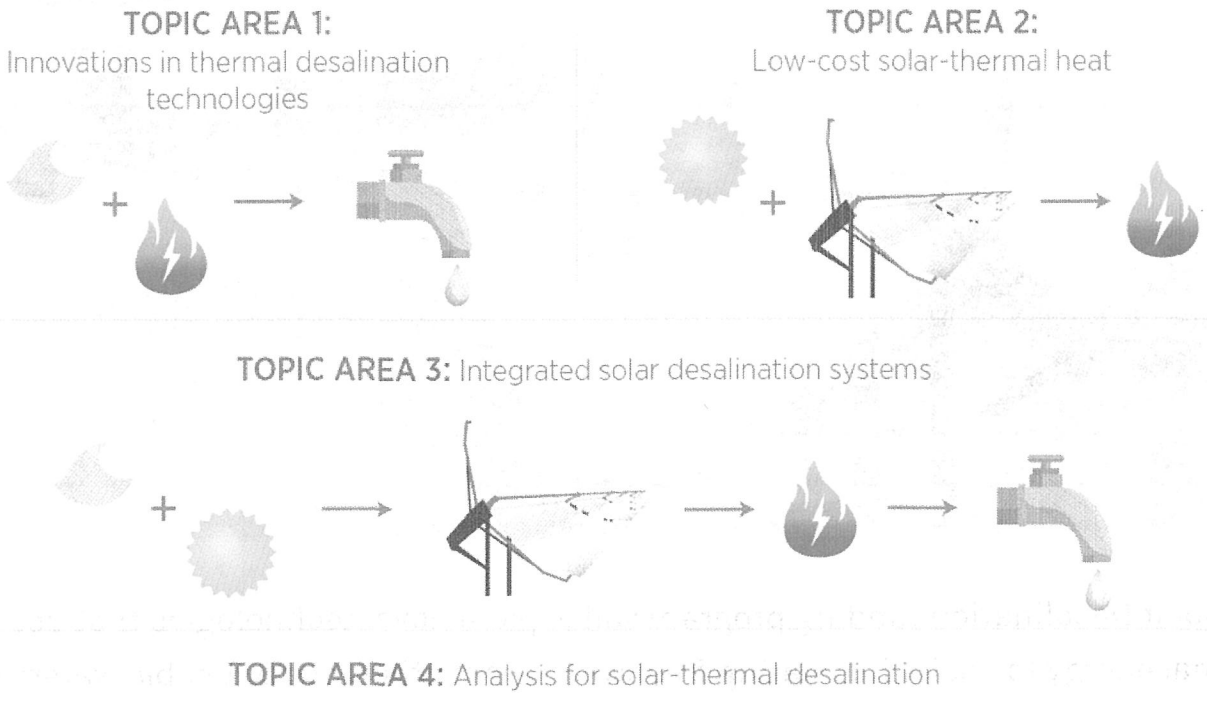


The Solar Desalination funding program will explore novel technologies that use solar-thermal energy to assist in creating freshwater from otherwise unusable waters like seawater, brackish water, and contaminated water. Improvements to thermal desalination technologies and low-cost, integrated designs for solar-thermal collection and storage can reduce the cost of desalination, while also enabling smaller and more portable systems.

Approach

The funding program addresses four topic areas:

- **In the first area, projects will focus on innovations that improve thermal desalination processes and efficiencies, while addressing challenges like scaling and corrosion.**
- **In the second topic area, projects will explore low-cost solar-thermal energy collection and storage technology that can reduce the levelized cost of heat (LCOH), as well as incorporate dispatchability and portability features.**
- **In the third topic area, projects will develop integrated solar-thermal desalination systems that can improve system efficiencies and reduce the levelized cost of water (LCOW).**
- **In the fourth topic area, the awardee will develop in-depth analysis tools needed to improve solar-thermal desalination.**



Objectives

for solar-thermal desalination. The projects aim to make improvements to current state-of-the-art and near-commercial systems, produce repeatable results, and include clear, market-driven objectives. Successful sub-components will be tested in an integrated system and will determine a credible pathway to commercial development.

Projects that address challenges for large-scale plants processing high-volume, low-salinity water, like sea water for a municipal utility, are expected to target a LCOW of $0.50 per cubic meter, to achieve wide applicability in the United States. Projects that address challenges for small-scale plants processing low-volume, high-salinity water, like brine from oil and gas operations target a LCOW of $1.50 per cubic meter.

Selectees

-- Award and cost share amounts are subject to change pending negotiations –

Topic Area 1: Innovations in thermal desalination technologies

FRAUNHOFER USA CENTER FOR ENERGY INNOVATION

Project Name: Solar-Driven Desalination by Membrane Distillation using Ceramic Membranes
Location: Storrs, CT
DOE Award Amount: $800,000
Awardee Cost Share: $332,088
Principal Investigator: Jeffrey McCutcheon
Project Summary: This project will develop and test ceramic membranes for solar-driven membrane distillation (MD) systems for desalination. The challenges that ceramic membranes face for MD applications are mass and heat transfer, wetting, scaling, and fouling. These challenges will be addressed by designing and optimizing

GREENBLU

Project Name: High-Efficiency, Zero Liquid Discharge, Multiple-Effect Adsorption Distillation
Location: Hamilton, NJ
DOE Award Amount: $1,600,000
Awardee Cost Share: $400,000
Principal Investigator: Dr. Howard Yuh
Project Summary: Adsorption distillation, a technology based on using materials that are able to adsorb large volumes of water vapor, is well-suited for zero liquid discharge applications where the incoming brine or waste water must be completely separated to produce only purified water and solid salt. This team will develop a multi-stage adsorption water distiller with the ability to use the same adsorbent beds for both a liquid-only distiller to concentrate brine and a liquid-solid crystallizer to generate solid salt by-products, by only altering only the input mechanics.

LAWRENCE BERKELEY NATIONAL LABORATORY

Project Name: Direct Solar-Thermal Forward Osmosis Desalination of Produced Waters
Location: Berkeley, CA
DOE Award Amount: $800,000
Awardee Cost Share: $200,000
Principal Investigator: Robert Kostecki
Project Summary: This team will develop an integrated ionic liquid-based forward-osmosis water treatment system for waters produced from high-salinity and/or high total dissolved solids levels which cannot be treated directly by reverse osmosis. By enabling the use of low-grade solar heat to drive the separation and regeneration

OREGON STATE UNIVERSITY

Project Name: Zero Liquid Discharge Water Desalination Process using Humidification-Dehumidification in a Thermally Actuated Transport Reactor
Location: Bend, OR
DOE Award Amount: $2,000,000
Awardee Cost Share: $500,000
Principal Investigator: Bahman Abbasi
Project Summary: This project will develop a hybrid process to treat high-salinity water with zero liquid discharge. The cost and efficiency of energy consumption are targeted to be competitive with large reverse osmosis desalination plants at a fraction of the capital cost. This will be accomplished by using thermally actuated nozzles—components that operate in response to temperature changes—that are heated with low-grade solar heat. These hot air jets are humidified with brine and the solid particles can be separated out. By condensing the water vapor and recouping the heat, this process will target a highly energy efficient cycle.

UNIVERSITY OF CALIFORNIA, LOS ANGELES

Project Name: Energy Where it Matters: Delivering Heat to the Membrane/Water Interface for Enhanced Thermal Desalination
Location: Los Angeles, CA
DOE Award Amount: $1,995,249
Awardee Cost Share: $516,644
Principal Investigator: David Jassby
Project Summary: This project will modify a typical membrane distillation (MD) system by deploying layers of materials with high thermal and electrical conductivity at the membrane/water interface. These conductive materials will be able to deliver solar-thermal energy directly to where it's needed in the MD system. By directly

Project Name: Solar Steam on Demand
Location: Livermore, CA
DOE Award Amount: $1,500,000
Awardee Cost Share: $1,000,000
Principal Investigator: Philip Gleckman
Project Summary: The most efficient distillation processes that use heat recovery require a steam source at a temperature around 180 °Celsius. This project will develop a novel solution for generating steam by using solar-thermal energy as the primary source of heat and developing a thermal energy storage solution for this temperature range based on phase-change materials. This solution will be combined with a previously developed low-cost, high-performance solar collector, creating a system that has the potential to continuously operate its distillation equipment and deliver a levelized cost of heat of 1.5 cent per kilowatt-hour even when the sun is not shining. Called Solar Steam on Demand, this solution meets the same requirements that exist in many other industrial heating applications.

UNIVERSITY OF CALIFORNIA, MERCED

Project Name: Low-Cost Dispatchable Heat for Small-Scale Solar-Thermal Desalination Systems
Location: Merced, CA
DOE Award Amount: $1,081,793
Awardee Cost Share: $277,133
Principal Investigator: Roland Winston
Project Summary: This team will design, build a prototype, and test a novel, low-cost solar-thermal energy system that can reduce the levelized cost of heat to below 1.5 cent per kilowatt-hour thermal, while also incorporating dispatchability and portability features. The project includes the design and development of a new collector or concentrator, called the Integrated Compound Parabolic Concentrator, as well as the design and development of an accompanying thermal energy storage system.

NATURAL ENERGY LABORATORY OF HAWAII AUTHORITY

Project Name: Hawaii SunShot Desal Project
Location: Kailua-Kona, HI
DOE Award Amount: $1,928,238
Awardee Cost Share: $2,311,938
Principal Investigator: Gregory P. Barbour
Project Summary: This project will advance the techno-economic viability of solar-powered forward osmosis (FO) by reducing the levelized cost of water (LCOW) 40 percent less than that of current state-of-the-art technology. The team will demonstrate a system that incorporates a concentrating solar thermal collector array delivering heat to a FO system. This system will utilize a new generation of membranes whose energy efficiency and durability will be demonstrated in this project. This system will then be installed and operated at an oceanic facility and the results will be used to scale up to a commercial-sized facility that can achieve the low targeted LCOW.

RICE UNIVERSITY

Project Name: Low-Cost Desalination using Nanophotonics-Enhanced Direct Solar Membrane Distillation
Location: Houston, TX
DOE Award Amount: $1,700,000
Awardee Cost Share: $787,124
Principal Investigator: Qilin Li
Project Summary: This project will develop and test a novel solar-thermal desalination process called Nanophotonics-Enabled Solar Membrane Distillation (NESMD), which uses a porous, photothermal membrane to simultaneously convert sunlight to heat and desalinate water by membrane distillation with very high thermal efficiency. The

Topic Area 4: Analysis for solar-thermal desalination

COLUMBIA UNIVERSITY

Project Name: GIS-Based Graphical User Interface Tools for Analyzing Solar-Thermal Desalination Systems and High-Potential Implementation Regions
Location: New York, NY
DOE Award Amount: $972,797
Awardee Cost Share: $274,481
Principal Investigator: Vasilis Fthenakis
Project Summary: This project will develop a software with state-of-the-art solar-thermal desalination models, verified with data from operating thermal desalination plants and data from solar-thermal desalination pilots at Plataforma Solar de Almeria in Tabernas, Spain. The software will also incorporate newly developed geospatial databases of alternative water resources. By integrating desalination techno-economic models and geospatial data layers in one interface, the developed software will assist with the planning and valuation of solar-thermal and hybrid technologies.

Learn more about the Solar Energy Technologies Office's concentrating solar thermal power research.

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