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July 21, 2014

Utah Public Service Commission
Heber M. Wells Building
160 East 300 South
Salt Lake City, UT 84114

Attn: Public Service Commission Chairman Ron Allen
Public Service Commissioner David Clark
Public Service Commissioner Thad LeVar
Executive Staff Director Becky Wilson

Re: Public comments, Docket No. 13-035-184, in the matter of Rocky Mountain Power's Intent to file a General Rate Case to charge $4.25 per month for net metering customers

I am looking forward to speaking and responding to your questions at your July 29, 2014 meeting. The attached paper will give you a heads up on some of my thoughts.

In 2012 three of us on the Salt Lake Community Solar Steering Committee selected the vendor to install solar electric systems on Utah homes. At the conclusion of the project I visited that vendor to understand of how the process worked in practice.

Based on that information I obtained I developed a significantly different plan. This plan will result in at least ***half of the homes in Utah*** having ***solar electric systems in five years***. No additional housing subsidies will be needed.

I have been consulting with businesses and some governments on unique ways of conducting their business since 1970 that has resulted in significant savings and improved operations. Based on those many years of experience I feel confident that 50% of Utah homes can have solar electric power in five years.

At some time in might be productive to share those plans with you. Now, however, the issue is the $4.25 that is being asked to be imposed on net metering homes. The attached paper suggests what the effect of this surcharge will have and what the economics are of their proposal.

Sincerely

Don Mignola, Consultant

Attachments:

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cc: Jordan White

Solar Electric Rooftop Panels
A Good Long Term but Poor Short Term Investment

Solar electric panels on the roof of a home are usually a good long term investment. That is because the warrants on the equipment and installation is usually 25 years and the payback is less than half of that.

The problem in the past has been that the monthly loan payments have usually been greater than the monthly savings on the electric utility bill – that is until the loan is paid off. This has discouraged about 3/4 of the home owners that have considered roof top solar electric panels.

We need to find ways of cost effectively reducing the monthly cost so that it is below the savings on the owner's monthly electric utility bill. In short, a net monthly savings. I have been exploring ways of doing so and know of programs that will make this possible.

The $4.25 will only make this more difficult. Many homeowners will fear future increases.

The Roll of the Electric Utility and the Electric Power Research Institute (EPRI)

EPRI is addressing the costs and other issues involved with net metering.

An important reading on this subject is EPRI's document titled, "The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources". A copy of this publication dated February 10, 2014 is attached. I urge any of you who have not had the opportunity to read this document to do so. This publication is Phase I which is the "Develop and Concept Paper". Phase II is the "Develop and Assessment Framework". It is expected to be published in August of 2014. Phase III is to "Conduct a Global Demonstration and Modeling Program".

EPRI research aims to making net metering reliable and cost effective. Never the less, each electric utility must invest to make net metering workable for them.

Electric utilities also incur some minor costs for each new net metering customer.

It is not clear what costs are incur every month – no backup. EPRI may provide some answers.

Electric utilities must invest in capacity to meet the need at high noon (not latter in the day for a typical hot day) on the hottest days of the hottest years when the air conditioners are running at full tilt and which may cause brown or black outs. This additional investment for peak capacity does not have a good payback since it is only needed for a few hours every few years.

Solar electric rooftops will reducing the electric utilities need to meet this minimally used capacity.

This investment savings should be far greater than $4.25 per solar electric rooftop home.

Air Quality is an Imperative

We must do everything we can to improve Utah's air quality. Every child with respiratory problems deserve better. Utah's autism rate is twice the normal rate. This may be caused by air pollution[1].

We must do everything we can to reduce global warming. Our water supply is already being impacted by global warming. Our ski resorts, restaurants and hotels will have fewer critical high revenue days.

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[1] If a pregnant mother is exposed to air traffic pollution during her pregnancy, the risk of autism in her offspring is greater, researchers from the University of Southern California and Children's hospital Los Angeles reported in Archives of General Psychiatry (November 2012 issue).

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The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources

Abstract

The electric power system has evolved through large, central power plants interconnected via grids of transmission lines and distribution networks that feed power to customers. The system is beginning to change – rapidly in some areas – with the rise of distributed energy resources (DER) such as small natural gas-fueled generators, combined heat and power plants, electricity storage, and solar photovoltaics (PV) on rooftops and in larger arrays connected to the distribution system. In many settings DER already have an impact on the operation of the electric power grid. Through a combination of technological improvements, policy incentives, and consumer choices in technology and service, the role of DER is likely to become more important in the future.

The successful integration of DER depends on the existing electric power grid. That grid, especially its distribution systems, was not designed to accommodate a high penetration of DER while sustaining high levels of electric quality and reliability. The technical characteristics of certain types of DER, such as variability and intermittency, are quite different from central power stations. To realize fully the value of distributed resources and to serve all consumers at established standards of quality and reliability, the need has arisen to integrate DER in the planning and operation of the electricity grid and to expand its scope to include DER operation – what EPRI is calling *the Integrated Grid.*

The grid is expected to change in different, perhaps fundamental ways, requiring careful assessment of the costs and opportunities of different technological and policy pathways. It also requires attention to the reality that the value of the grid may accrue to new stakeholders, including DER suppliers and customers.

This paper is the first phase in a larger Electric Power Research Institute (EPRI) project aimed at charting the transformation to the Integrated Grid. Also under consideration will be new business practices based on technologies, systems, and the potential for customers to become more active participants in the power system.

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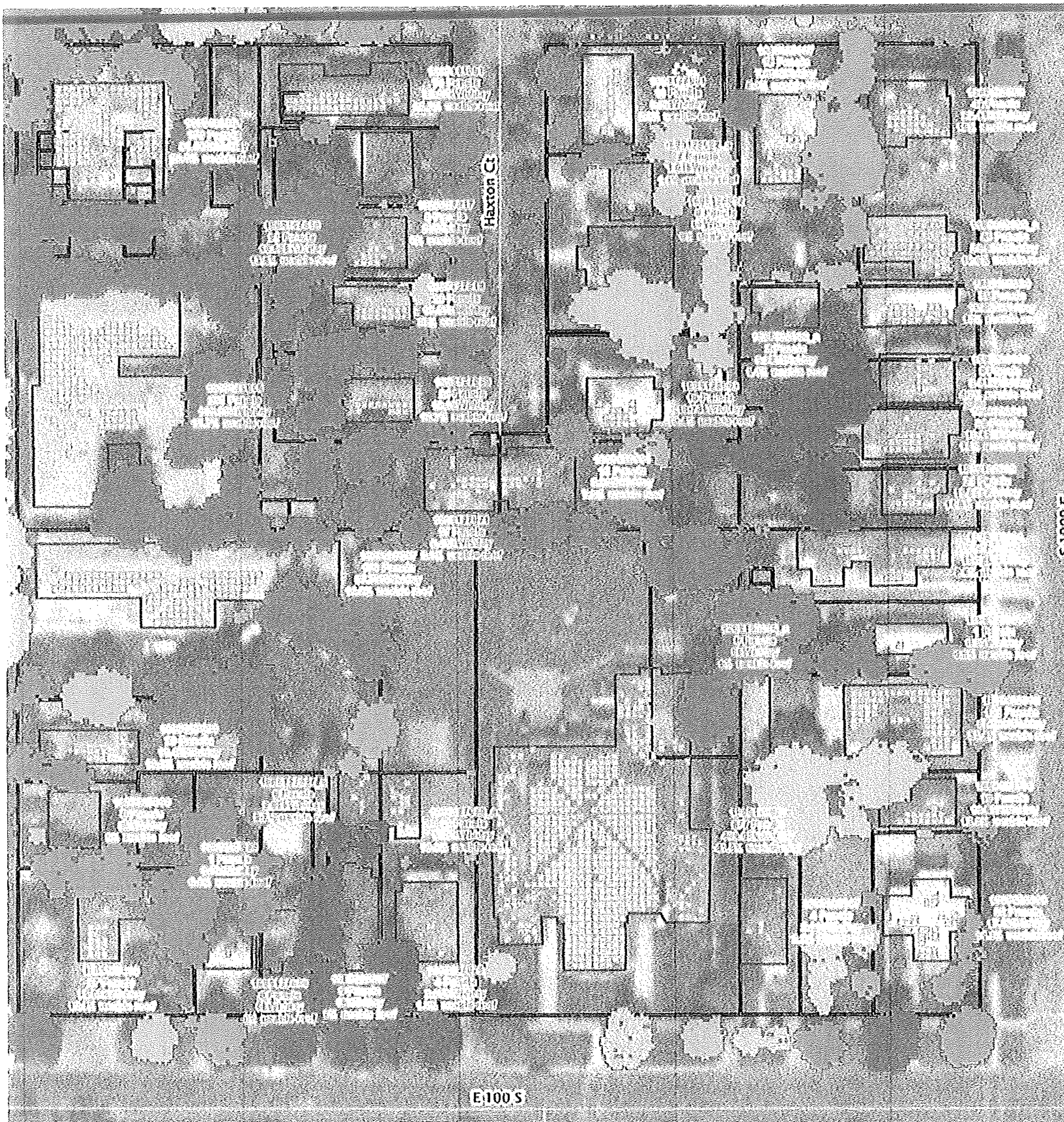
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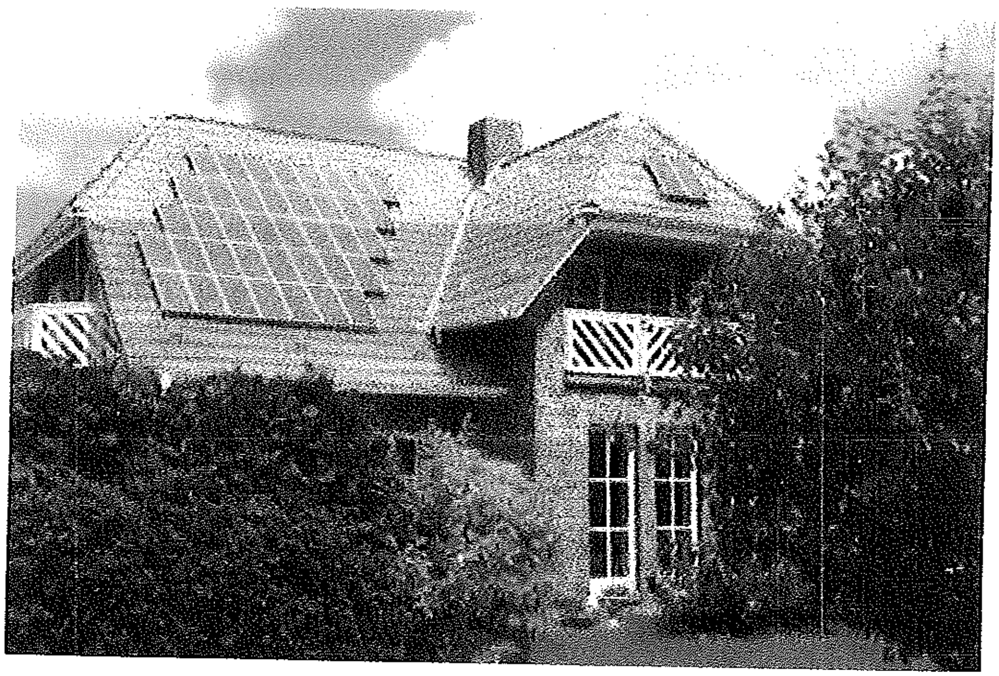
SMART GRID

Pilot Solar Energy Study



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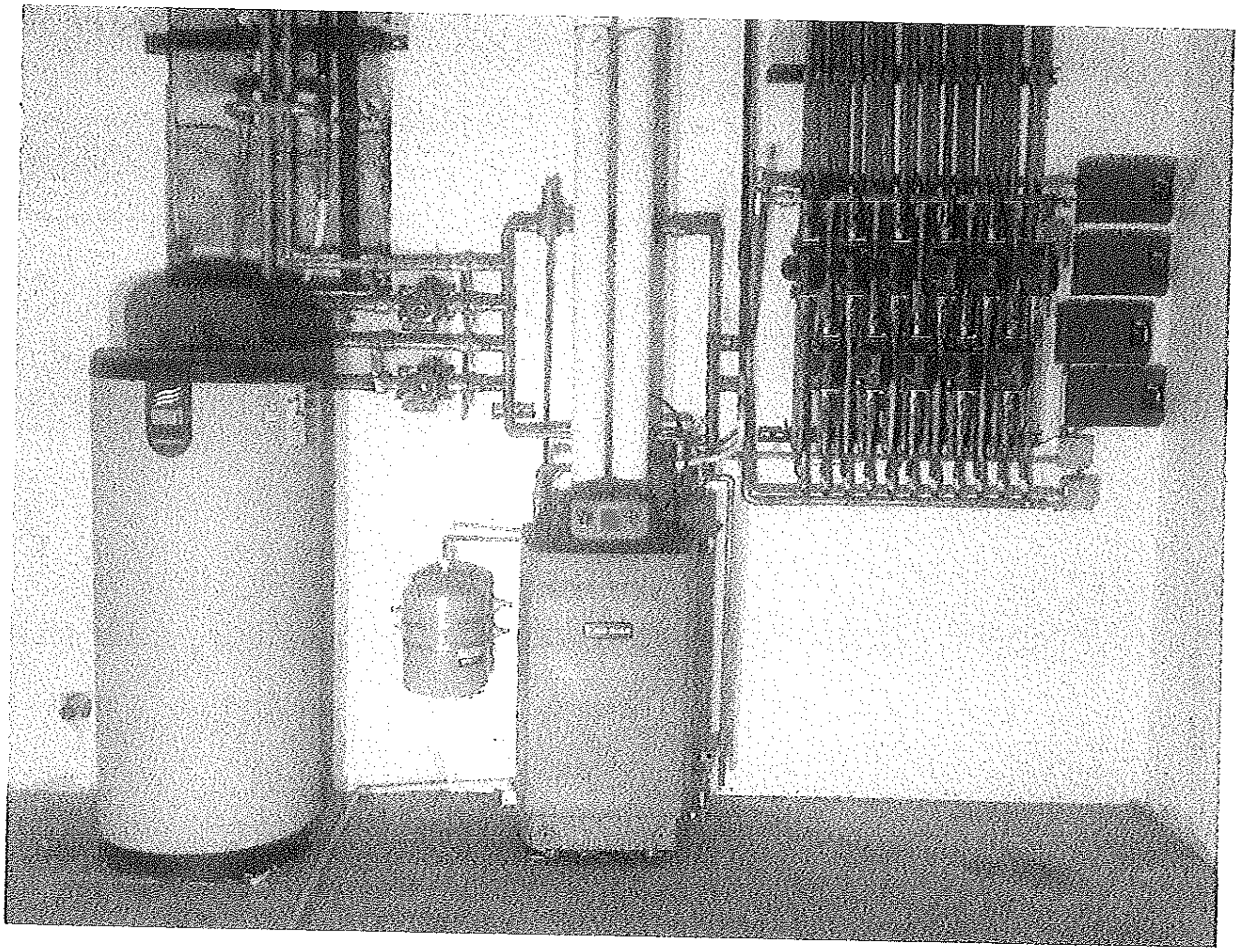
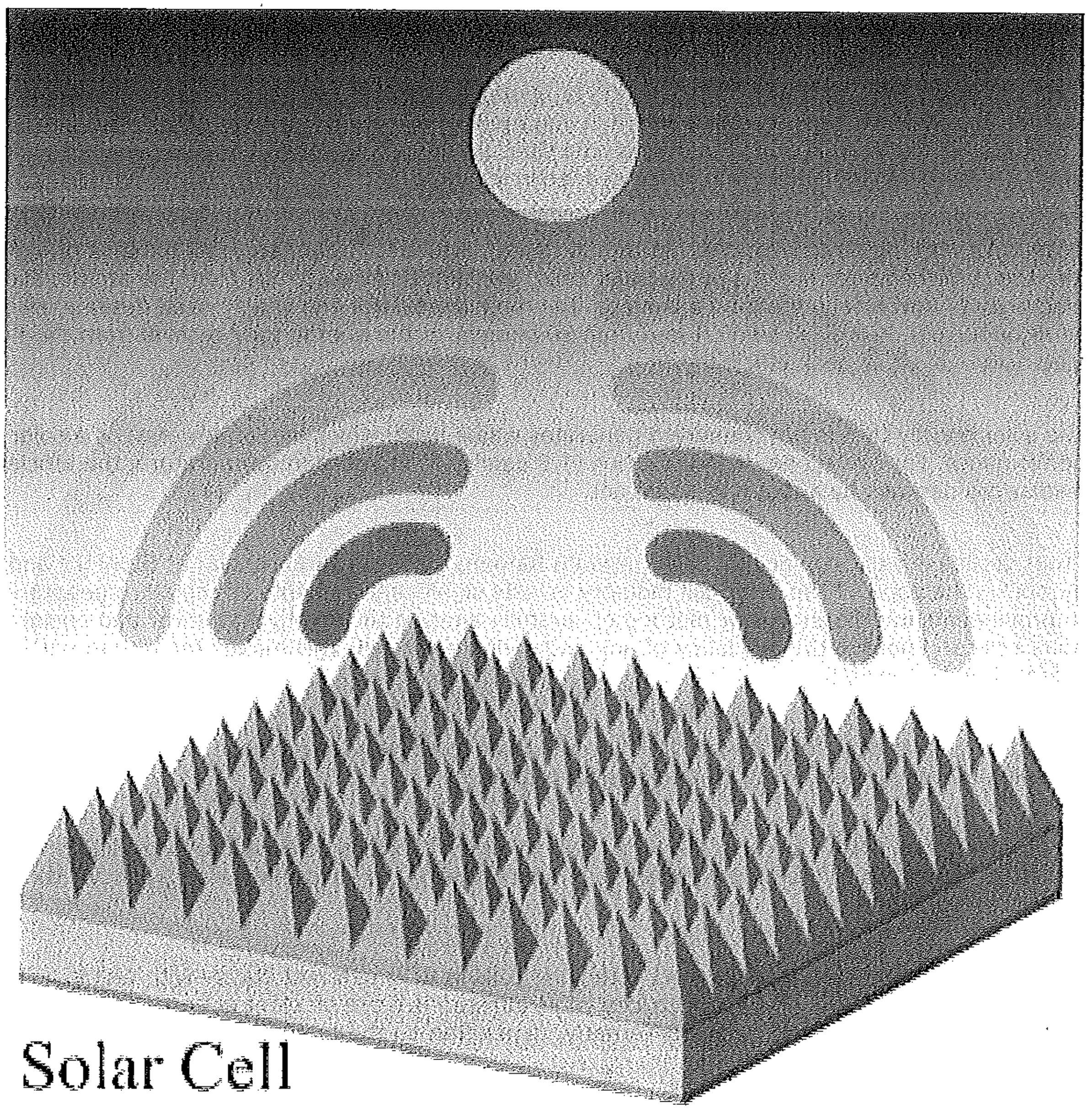


Self-cooling solar cells boost power, last longer

Tue, 07/22/2014 - 4:24pm

WASHINGTON — Scientists may have overcome one of the major hurdles in developing high-efficiency, long-lasting solar cells—keeping them cool, even in the blistering heat of the noonday Sun.

By adding a specially patterned layer of silica glass to the surface of ordinary solar cells, a team of researchers led by Shanhui Fan, an electrical engineering professor at Stanford University in California has found a way to let solar cells cool themselves by shepherding away unwanted thermal radiation. The researchers describe their innovative design in the premiere issue of The Optical Society's (OSA) new open-access journal *Optica*.



Solar cells are among the most promising and widely used renewable energy technologies on the market today. Though readily available and easily manufactured, even the best designs convert only a fraction of the energy they receive from the Sun into usable electricity.

Part of this loss is the unavoidable consequence of converting sunlight into electricity. A surprisingly vexing amount, however, is due to solar cells overheating.

Under normal operating conditions, solar cells can easily reach temperatures of 130 degrees Fahrenheit (55 degrees Celsius) or more. These harsh conditions quickly sap efficiency and can markedly shorten the lifespan of a solar cell. Actively cooling solar cells, however—either by ventilation or coolants—would be prohibitively expensive and at odds with the need to optimize exposure to the Sun.

The newly proposed design avoids these problems by taking a more elegant, passive approach to cooling. By embedding tiny pyramid- and cone-shaped structures on an incredibly thin layer of silica glass, the researchers found a way of redirecting unwanted heat—in the form of infrared radiation—from the surface of solar cells, through the atmosphere, and back into space.

"Our new approach can lower the operating temperature of solar cells passively, improving energy conversion efficiency significantly and increasing the life expectancy of solar cells," said Linxiaò Zhu, a physicist at Stanford and lead author on the *Optica* paper. "These two benefits should enable the continued success and adoption of solar cell technology."

Solar cells work by directly converting the Sun's rays into electrical energy. As photons of light pass into the semiconductor regions of the solar cells, they knock off electrons from the atoms, allowing electricity to flow freely, creating a current. The most successful and widely used designs, silicon semiconductors, however, convert less than 30 percent of the energy they receive from the Sun into electricity - even at peak efficiency.

The solar energy that is not converted generates waste heat, which inexorably lessens a solar cell's performance. For every one-degree Celsius (1.8 degree F) increase in temperature, the efficiency of a solar cell declines by about half a percent.

"That decline is very significant," said Aaswath Raman, a postdoctoral scholar at Stanford and co-author on the paper. "The solar cell industry invests significant amounts of capital to generate improvements in efficiency. Our method of carefully altering the layers that cover and enclose the solar cell can improve the efficiency of any underlying solar cell. This makes the design particularly relevant and important."

In addition, solar cells "age" more rapidly when their temperatures increase, with the rate of aging doubling for every increase of 18 degrees Fahrenheit.

To passively cool the solar cells, allowing them to give off excess heat without spending energy doing so, requires exploiting the basic properties of light as well as a special infrared "window" through Earth's atmosphere.

Different wavelengths of light interact with solar cells in very different ways—with visible light being the most efficient at generating electricity while infrared is more efficient at carrying heat. Different wavelengths also bend and refract differently, depending on the type and shape of the material they pass through.

The researchers harnessed these basic principles to allow visible light to pass through the added silica layer unimpeded while enhancing the amount of energy that is able to be carried away from the solar cells at thermal wavelengths.

"Silica is transparent to visible light, but it is also possible to fine-tune how it bends and refracts light of very specific wavelengths," said Fan, who is the corresponding author on the *Optica* paper. "A carefully designed layer of silica would not degrade the performance of the solar cell but it would enhance radiation at the predetermined thermal wavelengths to send the solar cell's heat away more effectively."

To test their idea, the researchers compared two different silica covering designs: one a flat surface approximately 5 millimeters thick and the other a thinner layer covered with pyramids and micro-cones just a few microns (one-thousandth of a millimeter) thick in any dimension. The size of these features was essential. By precisely controlling the width and height of the pyramids and micro-cones, they could be tuned to refract and redirect only the unwanted infrared wavelengths away from the solar cell and back out into space.

"The goal was to lower the operating temperature of the solar cell while maintaining its solar absorption," said Fan. "We were quite pleased to see that while the flat layer of silica provided some passive cooling, the patterned layer of silica considerably outperforms the 5 mm-thick uniform silica design, and has nearly identical performance as the ideal scheme."

Zhu and his colleagues are currently fabricating these devices and performing experimental tests on their design. Their next step is to demonstrate radiative cooling of solar cells in an outdoor environment. "We think that this work addresses an important technological problem in the operation and optimization of solar cells," he concluded, "and thus has substantial commercialization potential."