Solar San Francisco

Cities such as San Francisco have declared themselves major advocates of solar power, and have ambitious plans to install solar systems on municipal buildings and throughout commercial and residential sectors under their jurisdiction.

Courtesy of SFPUC

Workers install solar panels on the Moscone Center.

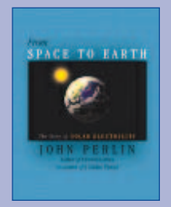
Systems such as this 675 kW installation being completed at the Moscone Convention Center in San Francisco have caught the imagination of the public worldwide. The installation provides diversity of supply, savings to the Moscone Center, and increased stability to the local grid.

Courtesy of SFPUC

An extensive solar monitoring network indicates that much of San Francisco receives enough solar fuel to put the sun to work throughout the City.

Learn more about Solar Electricity

John Perlin, ***From Space to Earth: The Story of Solar Electricity***, Cambridge, Massachusetts; Harvard University Press, 2002



www.californiasolarcenter.org

Read about incentives available, relevant legislation, history of solar energy, and current events in California via free online newsletter ***Solar e-Clips***. Provided by The Rahus Institute.

www.votesolar.org

Learn how San Francisco voters passed a bond measure in 2001 to help fund the installation of solar electric systems on city buildings. Read about efforts to replicate this effort in other cities.

www.solarschoolhouse.org

A solar for schools program developed by The Rahus Institute, providing teacher training, hands-on lessons/ equipment, and small grid-tie PV s ystems for schools.

www.solarsf.org

Website with information about solar energy activities in San Francisco.

www.energy.ca.gov/pier

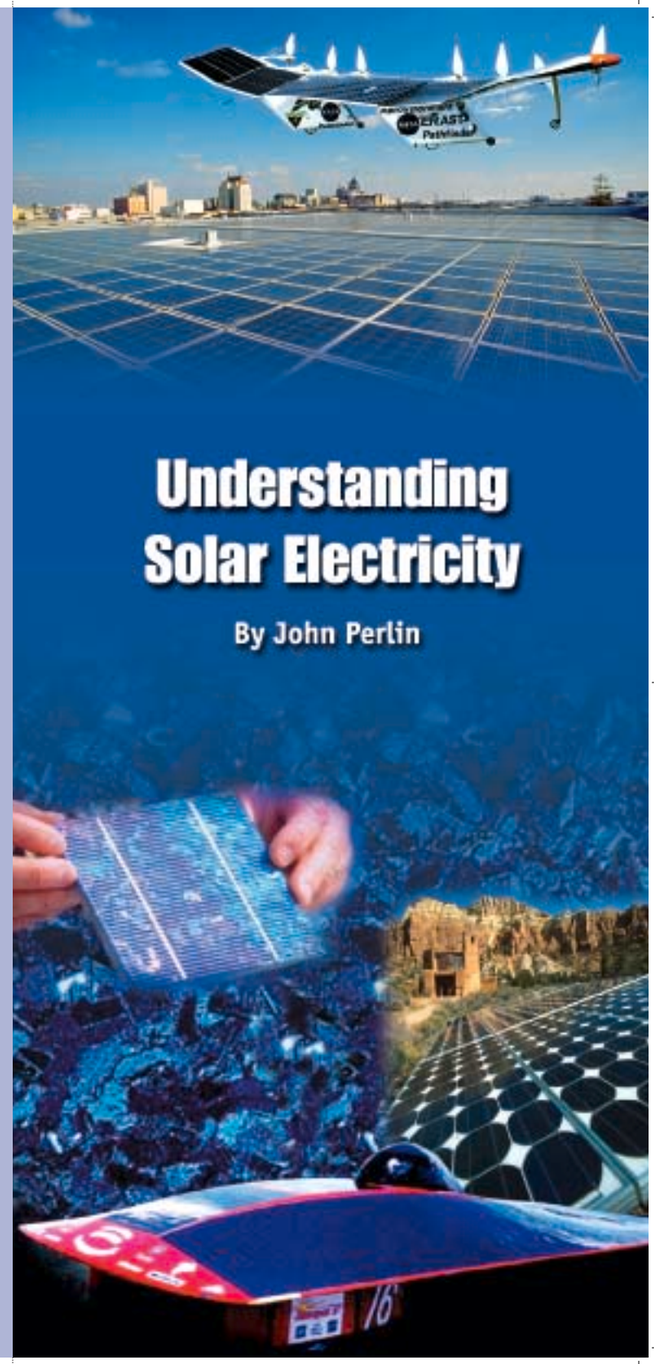
The California Energy Commission Public Interest Energy Research program. Read about ongoing solar development projects.

San Francisco Public Utilities Commission Solar Program

To learn more about the SFPUC Solar Program contact Fred Schwartz at fschwartz@sfwater.org

Produced by The Rahus Institute
www.rahus.org

Design by Liz Rush

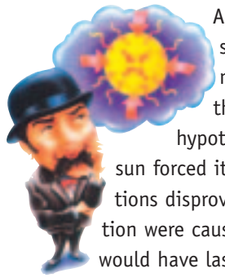


Understanding Solar Electricity

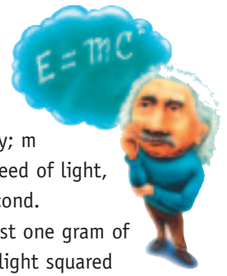
By John Perlin

For many years, people believed that the sun got its energy through combustion.

Scientists, however, figured that the amount of energy produced in this fashion meant that the sun would have lasted only around 10,000 years.



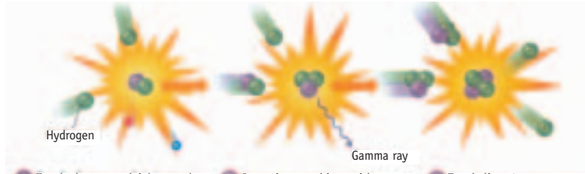
As science became more sophisticated, people realized they needed a better explanation for how the sun worked. Scientists then hypothesized that gravity pushing on the sun forced it to release its energy. But calculations disproved this theory as well. If gravitation were causing the sun to generate energy, it would have lasted just 45 million years.



Einstein's famous equation, $E=mc^2$, finally explained how the sun could produce such large quantities of energy and remain functioning for billions of years. E stands for energy; m represents matter; while c is the speed of light, which travels 186,000 miles per second. According to Einstein's equation, just one gram of matter accelerated to the speed of light squared generates 25 million kilowatt-hours of power.

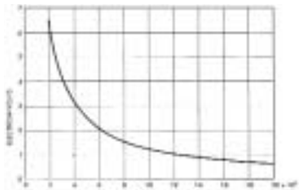
Illustrations Courtesy of Holt, Rinehart, & Winston

Fusion of Hydrogen in the Sun

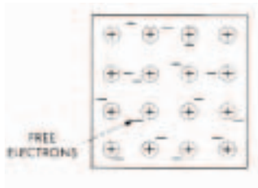


1. Two hydrogen nuclei (protons) collide. One proton emits particles and energy, then becomes a neutron. The proton and neutron combine to produce a heavy form of hydrogen called deuterium.
2. Deuterium combines with another hydrogen nucleus to form a variety of helium called helium-3. More energy is released, as well as gamma rays.
3. Two helium-3 atoms then combine to form ordinary helium-4, releasing more energy and a pair of hydrogen nuclei.

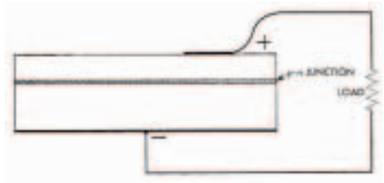
Einstein and his quantum colleagues demonstrated that at the core of the sun the temperature is so hot and the pressure is so great hydrogen atoms fuse to form helium. In the process, a great amount of energy is released.



Einstein further demonstrated that much of this energy pours down on us as light. The amount of energy light carries varies according to wavelength, the shorter the wavelength, the more power it packs. The shortest wavelengths, for example, contain four times more power than the longest do.



Technologists can prepare certain materials called solar cells so that some of their electrons lose their nuclear glue, allowing incoming light with sufficient power to move them. The built-in electrical force in the solar cell known s the p-n junction pushes these freed electrons in an orderly flow, producing electricity.



Charts Reprinted with permission of AT&T Archives

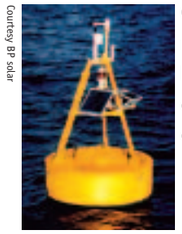
Illustration Courtesy of Holt, Rinehart, & Winston

Reprinted with permission of AT&T Archives

The greatest breakthrough in solar cells occurred in 1954. Scientists Daryl Chapin, Calvin Fuller, and Gerald Pearson discovered how to make solar cells convert enough sunlight directly into electricity to produce useful amounts of power.

Courtesy NASA

Satellites were the first to use such solar cells, making the commercial, military, and scientific use of space possible. Since powering the small Vanguard satellite in 1958, solar cells have run almost every satellite ever launched. Solar's role as the principal power source in space has made the technology indispensable to modern life. Beginning with the Gulf War, no American military force could fight without guidance from space. Satellites also enable the global economy. They orchestrate the harmonious meshing of disparate bits of data so global telecommunications operate seamlessly. Solar-powered satellites coordinate the movement of people and goods in the air, on land, and by sea, and they allow companies to keep abreast of their far-flung assets. Only when communication satellites came of age did live television broadcasts from across the seas become possible. We have learned much about the universe and our planet thanks to the Hubble telescope and remote sensing, both accomplished by satellite.



Courtesy BP solar

On earth, solar cells run almost all navigational aids — buoys, lighthouse lights as well as warning lights and horns on man-made structures such as offshore oil rigs.

Courtesy John Perlin Solar Archives

Since 1985 solar cells have become the power system of choice for telecommunications in remote areas of the world.

Solar cells power tens of thousand of water pumps for irrigating crops, and for drinking water for people and livestock.

Courtesy John Perlin Solar Archives

Courtesy of Shell Solar

Solar cells have brought electricity to millions who had hitherto done without.

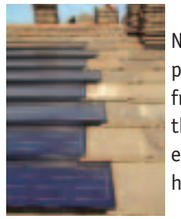
Courtesy John Perlin Solar Archives

Many times new power needs come up and lines have to be placed underground. In such instances, it is cheaper to put up solar-electric panels onsite, as it would cost more to dig up asphalt and concrete to connect to existing power sources. Applications include streetlights, call boxes, and warning lights at pedestrian crossings.

Courtesy of Pilkington Solar International

Solar cell material doubling as curtain wall, overhangs; roofing, and/or skylights make the technology a cost-effective supplementary energy source for commercial buildings.

Courtesy of Astropower



Net metering — where the utility purchases excess electricity generated from solar panels — has encouraged those already hooked up to the electrical grid to install solar for homes and apartments.