

All About: Concentrated Solar Power (CSP)

By Rachel Oliver
For CNN

(CNN) -- What if you could provide the world with an endless supply of virtually carbon-free electricity; ensure a constant source of drinkable water to the world's most vulnerable areas; avert some of the world's future humanitarian crises; and save billions of dollars in the process? Certain concentrated solar power (CSP) proponents say there is no "could" about it -- it's more a case of "can."



CSP provider Stirling's dish assemblies soak up the sun at an air force base in New Mexico.

Like [photovoltaic systems](#) (PV), CSP relies on the sun to work. But where PV relies on mirrors to directly translate the sun's rays into energy, CSP uses the sun to heat water, or other liquids, to high temperatures, whose resulting steam is then used to drive turbines that create electricity.

CSP is generally accepted to be more cost effective than PV, and more practical, as it can power on throughout the night, without the aid of the sun, thanks to its thermal storage capabilities. (The excess heat is stored as hot liquid, or is transferred to other materials such as molten salt, or graphite, where it can be used throughout the night, or on cloudy days.)

Whereas PV can work on cloudy days, CSP needs direct sunlight -- and a lot of it, which means the only practical places on earth CSP plants can really work are in deserts. Deserts typically attract three times as much sunlight as northern Europe, according to The Guardian. It's why California's Mojave Desert has traditionally been the world centre for CSP, home to the world's biggest CSP plants, and is attracting companies from Australia, Germany, Israel and Spain to set up there, according to Business 2.0.

Proponents of CSP say you don't need to use up much of the desert space to make CSP effective. A solar farm taking up 92 by 92 miles of desert could power the entire U.S., for example, according to Green Wombat, referring to a calculation made by the chairman of solar company Ausra, David Mills.

Over in Europe, however, a group of scientists, politicians and renewable energy experts who call themselves The Trans-Mediterranean Renewable Energy Cooperation (TREC) have made claims on a much bigger scale and with far bigger ramifications.

TREC is backing an ambitious project straddling Europe, the Middle East and North Africa (EU-MENA), which is based on the calculation that an area less than 0.3% of the Sahara Desert filled with CSP plants could power the entire region -- and could slash the EU's electricity-generated greenhouse gas emissions by 70% in the process.

The CSP-generated electricity would be transmitted around the region via a "supergrid" of high voltage direct current (HVDC) transmission lines. The CSP plants, TREC says, would "generate enough electricity and desalinated seawater to supply current demands in EU-MENA, and anticipated increases in those demands in the future."

One of the byproducts of CSP, waste heat, can be used to desalinate seawater (conversely, it can produce thermal cooling, otherwise known as air conditioning). And this is what TREC believes will make it more appealing for the MENA region, as its CSP project will effectively enable the countries there to avert the kind of crises in the future that people now commonly refer to as the Water Wars.

As the years progress, water supplies will become more of a pressing issue for MENA states in particular. According to Dr Franz Trieb, a scientist with the German Aerospace Center (DLR) (TREC's projections are largely based on DLR research), out of 20 countries analyzed in MENA, just four of them "are well above the threshold ... that is commonly considered as a demarcation line of water poverty".

By 2050, Trieb points out, in addition to suffering economically ruinous oil shortages, the entire MENA region will be facing "a serious water crisis."

One square kilometer in MENA attracts the equivalent amount of energy from the sun as 1.5 million barrels of oil, says Trieb. It is also enough to desalinate 60 million cubic meters of water a year, he says. By providing the EU and "sunbelt countries" with a source of clean energy, MENA gets a guaranteed source of non-oil related energy income in the future -- as well as drinking water.

And this, TREC says, is what will make CSP such a big money saver over time.

Serving the Yemeni city of Sana'a for example, "which is facing the exhaustion of its ground water reserves in about 15 years", CSP-treated water will save the international community billions of dollars in the future, when millions leave their homes for lack of water, it argues. Moving 2 million of Sana'a's citizens to new homes will cost around \$44 billion. But it would cost \$7 billion to build the CSP plants, which would prevent them leaving in the first place, TREC argues.

According to a speech given by Gerhard Knies, a scientist with DLR, it is not just EU-MENA which could benefit from this type of project, either. CSP could serve 90 percent of the world's population, he says, as 90 percent of us live within 2,500 km of desert (living further away than 2,500 km would result in higher transmission losses and higher costs).

CSP is attracting a list of high profile champions in the field of commerce, including venture capitalist Vinod Khosla. Khosla was one of the early backers of Google, Amazon and AOL and his latest venture is to invest in CSP, according to The Toronto Star. He favors CSP over "clean coal," or Integrated Gasification Combined Cycle (IGCC) produced coal, arguing that CSP plants are cheaper and quicker to build.

He recently told the newspaper: "[Solar thermal is] a great technology, and about one-fourth the cost of PV with the kind of reliability that utilities actually like. We can be cheaper than IGCC coal, even for our first (solar thermal) plants. I'll beat them any day of the week on price, and I'll build them more quickly. I'll challenge anybody with this."

He is not the only one who believes CSP can be as cost effective as fossil fuels. Ausra's Mills also calculates that with 16 hours of storage capacity, CSP could supply "92 percent of [Texas and California's] power at about 8 cents a kilowatt hour -- roughly the current cost of fossil fuel-generated electricity," reports Green Wombat.

The founder of Greenpeace Lebanon, Fouad Hamdan, also argues it makes economic sense when compared with many world politicians' favored solution to climate change -- nuclear energy. Writing in Lebanon's Daily Star, he argues that when comparing nuclear energy and CSP like-for-like on a cost basis, nuclear becomes "economically insane."

"Investing in nuclear is a huge waste of money," Hamdan writes. "Plans to build a CSP in Egypt are estimated at \$140 million for 140 MW, or about \$1 million per MW. In comparison, the cost to build a nuclear power plant is estimated to be at least at \$1.5 billion for 1,000 MW - about \$1.5 million per MW."

But despite CSP's obvious selling points, it has many obstacles to get past before it becomes reality. And in what would be the ultimate twist of irony, some of CSP's biggest opponents in the future could in fact be environmentalists.

Earlier this year, CSP industry leader Stirling Energy Systems' contract to supply CSP-generated energy to San Diego Gas & Electric came under attack in the U.S. by local green groups -- because the planned transmission line will plough through a state park and "other environmentally sensitive lands," according to Green Wombat.

But while environmentalists can make things unpleasant, politicians can make things impossible. A small number of media sources have been reporting recently that there is a growing possibility that U.S. Democrats will allow solar and wind energy tax credits and a renewable portfolio standard (which obliges utilities companies to produce a certain amount of their energy from renewable sources) to be stripped from the forthcoming U.S. Congressional Energy Bill. It has the U.S. renewable energy industry in a state of panic.

Such a move, The New Republic writes, "would throttle the U.S. renewable industry," with Grist adding it would be "imperiling probably billions of dollars in solar and wind contracts that have been written with the expectation that the production tax credits will lower costs to investors and consumers."

The Solar Energy Industries Association is currently spearheading a campaign to urge as many people as possible to ask their representatives to lobby two key Democrats -- House Speaker Nancy Pelosi and Senate Majority Leader Harry Reid -- to keep the Solar Investment Tax Credit extension in the Bill.

(Sources: The Guardian; Business 2.0; Green Wombat; Trans-Mediterranean Renewable Energy Cooperation; "Clean Power from Deserts: Does CSP offer a solution to global warming and climate change?" by Gerhard Knies, German Aerospace Center; "Concentrating Solar Power for Seawater Desalination" by Dr Franz Trieb, German Aerospace Center; Daily Star; Toronto Star; The New Republic; Grist; Solar Energy Industries Association)