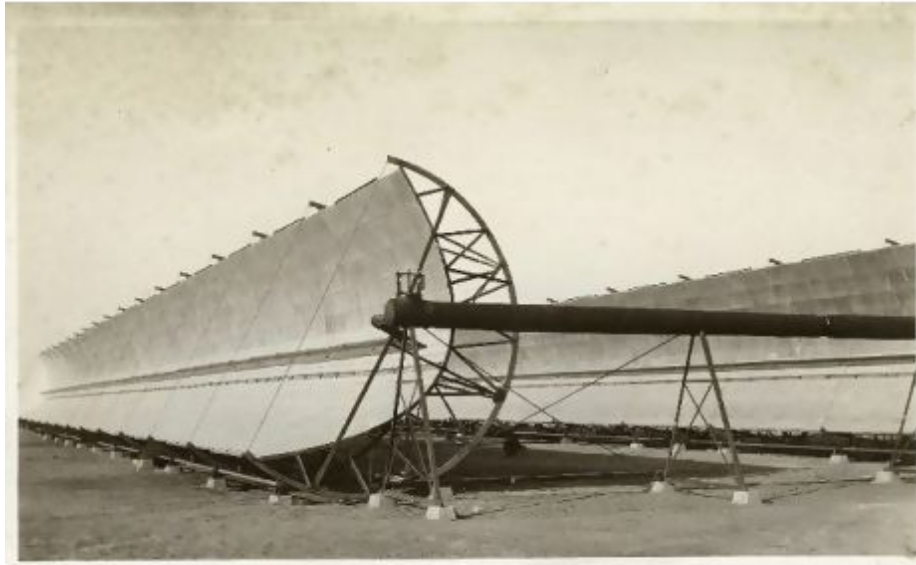


The promise of solar power, made a century ago



Try this at home. Take a shallow tin pan, paint it matte black on the inside, insulate the bottom and sides as best you can - try cotton wool - and pour in a small amount of water. Cover it with a pane of glass, put it outside in direct sunlight and, presto, the water will boil and give off steam.

Congratulations. You have just saved the planet - and, perhaps, solved the UAE's power problems.

This, in essence, is the technology behind the three-square-kilometre Concentrated Solar Power (CSP) plant on which work has begun in the desert 120km south-west of the capital city. Shams 1 will use the concentrated heat of the sun's rays to make steam and drive turbines that can generate enough electricity to supply 60,000 homes.

CSP technology is simple, effective and harmless to the environment. It can even be used to produce desalinated drinking water as a by-product. Surprisingly, it is 100 years old, which, during the week Abu Dhabi hosted the World Future Energy Summit, raised two simple questions: what have we been waiting for, and why can't the UAE solve its looming energy crisis by simply covering vast tracts of its sun-kissed deserts with CSP plants?

The answers, of course, are more complex than the questions.

The experiment above was described in 1916 by Frank Shuman, a US inventor from Philadelphia, to explain the principle behind a solar-generating plant he had set up in 1913 in Egypt at Maadi, today a suburb of Cairo. To create his Number One Sun Engine, Shuman used five 60-metre-long parabolic "troughs", mirror-lined heat absorbers aligned to track the sun's

progress across the sky, to concentrate the rays onto five matte-black boilers, which then produced sufficient steam to pump almost 23,000 litres of water a minute.

Shuman's plant successfully irrigated agricultural land alongside the Nile for two years, but it could just as easily have been used to operate an electricity-generating turbine, as he intended it should.

Backed by UK investors and interest from the British and German governments, Shuman had a grand plan: to build a series of giant solar plants in the Sahara to challenge the supremacy of King Coal. "You would only need 20,250 square miles [52,450 sq km] in the Sahara in order to supply the whole world with energy," he calculated. "One thing I know for sure. If mankind does not learn how to harness the power of the sun, he will ultimately fall back into barbarity."

But mankind was not yet ready to be saved. The First World War put paid both to the Maadi plant, which was broken up for scrap metal to supply Britain's munitions industry, and the Sahara project. Shuman died in 1918 and, when vast and easily accessible oil deposits were discovered in Iraq and Iran after the war, his dream of cheap, clean solar power was buried with him.

The technology flared into life again briefly in the 1980s, when a number of plants were built in the United States in response to the oil crisis. But when the black stuff started flowing again, solar was once more put on the back burner. One hundred years after Maadi, a "fall back into barbarity" might not be looming but there is certainly mounting concern over global warming and CSP technology is being resurrected.

Shuman's broader vision has been taken up by the Desertec Foundation, an international nonprofit collaboration of scientists, concerned individuals and alternative-energy companies that believes a combination of solar power from the world's deserts and wind power can provide all the electricity we need. What's more, it envisages a network of High Voltage Direct Current (HVDC) lines connecting the countries that have these resources with those that need them. With HVDC lines now capable of carrying power more than 2,500km without serious losses, countries in the Mena region could not only provide all their own electricity, but could sell excess power to Europe and beyond.

Potentially, the UAE is poised to become part of that grander scheme. In June, Masdar announced it had teamed up with the energy company Total and Abengoa Solar, a Spanish firm and one of the founding partners of the Desertec initiative, to build and operate the first large-scale solar power plant in the Middle East.

Shams 1, under construction at Madinat Zayed, will have a capacity of 100MW when it comes online next year, but it will not hold the lead for long in the accelerating solar power race.

For a start, it will be overshadowed in the United States by two other Abengoa projects, each capable of generating 250MW. But the country in this region with the biggest solar ambitions is Morocco, which in 2009 unveiled plans for a project worth US\$9 billion (Dh33bn) designed to supply more than one-third of the country's generating capacity by 2020, a massive investment

for the country, but one it hopes ultimately to recoup by selling electricity across the Mediterranean through the proposed Desertec network.

It is no secret the UAE's demand for power is outstripping its capacity. The key fact underpinning the country's nuclear energy policy, published in April 2008, was that peak demand for electricity, rising by about 9 per cent a year, was expected to hit 40,000MW by 2020 - double existing capacity. By then, there would not be enough natural gas available and, while burning crude oil, diesel or even coal would be "logistically viable", the economic and environmental costs would be too high.

A second 100MW plant, using photovoltaic technology - solar cells that generate electricity directly - is planned for Al Ain. Although this is a start, the total contribution of renewables, including the planned installation of home PV units on rooftops, is not expected to exceed 1,500MW by 2020, a fraction of the UAE's anticipated 20,000MW shortfall.

So why is not the UAE simply covering its deserts with CSP?

After all, a back-of-the-envelope calculation based on the size and capacity of Shams 1 shows that to generate the UAE's entire 20,000MW shortfall by 2020 would require 200 such plants covering a total of 700 square kilometres of desert (Abu Dhabi has about 67,000 going spare).

In making its case for nuclear power - four plants costing \$20bn are expected to be online by 2020 - the UAE believes alternative energy can play only a relatively small role in closing its energy gap. According to the 2008 policy document: "Evaluation of alternative energies, including solar and wind, suggested that ... even aggressive development could only supply 6 to 7 per cent of peak electricity demand by 2020."

Mohammed al Zaabi, the general manager of the Shams Power Co, says it is important to see solar's role in a wider context.

"Shams 1 is the first major step towards achieving the seven per cent target of renewable energy by 2020. It is going to pave the way for future projects to come online. It is one of the largest solar power projects around the world, so it is important for Abu Dhabi, but also being observed by the international community to see how successful this project is."

It would not be prudent, he says, for Abu Dhabi simply to cover the desert with CSP plants and rely on a single energy technology. "Abu Dhabi is investing in different technologies for different reasons, including energy security and diversity, and also to make sure that we reduce the carbon footprint of Abu Dhabi. So it is also investing in conventional power, nuclear and renewable energy."

Most of the seven per cent target for renewables will be achieved through solar, but while CSP is the oldest proven technology in the field, "we are also evaluating the options for the other solar technologies, such as photovoltaic, which has been improving dramatically over the past few years. We are not only looking at the technical aspects of each technology, we are trying to get the best technology for Abu Dhabi, which also has the best cost".

The accepted wisdom is that solar power is by far the most expensive way to generate electricity and is, therefore, economically unviable. A widely cited March 2010 report by Booz & Co, a global management-consulting firm with offices in Abu Dhabi, concluded that, with an estimated cost of up to 30 US cents per kilowatt-hour (kWh), electricity produced by solar power was up to six times more expensive than generation using natural gas.

True, based on its estimated cost of \$600 million, scaling Shams 1 to the power of 200 would cost \$120bn. But according to Abengoa, Masdar's Spanish technology partner in the Shams 1 project: "Mass production and economies of scale will reduce solar electricity costs to a competitive level with the next 10 to 12 years."

In any case, say supporters of solar power, even the apparent price gap is not as wide as it appears. For one, once a solar plant is up and running there are no fuel costs and, most crucially, "energy markets are terrifically distorted", says Gerry Wolff, one of Desertec's international coordinators. "And the main distortion is that fossil fuels are still receiving quite large subsidies around the world."

Indeed, the highest hurdle still facing most renewable-energy projects around the world are subsidies that serve to widen the gap between fossil fuels and solar and other technologies.

This is particularly true in the UAE, according to "The Basis of Abu Dhabi's Quest for Renewable Energy and Policies Required to Meet its Goals", a report published in September by the Dubai School of Government. Abu Dhabi, it noted, supplied gas to its generating plants for about \$1 to \$2 per million BTUs [British Thermal Units, a standard measurement of energy], "which is the rough equivalent of selling oil at \$6 to \$12 per barrel when world market prices are near \$80".

This dramatic underpricing meant domestic consumers in Abu Dhabi paid less than two US cents per kWh compared with the 10 cents paid by US consumers.

The scale of the subsidy - and the implication that the Government is paving the way for the sort of price adjustments already seen at petrol pumps - is being brought home to consumers. In letters being distributed along with its bills, Abu Dhabi Distribution Co is pointing out to householders that water and electricity in Abu Dhabi "costs much more to produce than you pay".

An Emirati family living in a four-bedroom villa, for example, pays nothing for its water and typically only Dh559 a month for electricity. If the subsidies disappeared, the family would face a monthly bill for water and electricity of Dh3,920, a hike of more than 600 per cent. An expatriate family living in a three-bed flat would see their bill increase to Dh636 from Dh327, a rise of almost 95 per cent.

The letters follow a 2009 report by the Abu Dhabi Regulation and Supervision Bureau, which revealed that in 2006 residents each consumed an average of 41,000kWh of electricity - almost four times as much as their counterparts in the United States.

"Why are we telling you about the 'waived cost'?" ADDC's letter asks its customers. "So that you know the true value of water and electricity. We believe this will encourage many people to take greater care when using these resources."

Mr al Zaabi agrees that "to have fair competition between renewable energy and conventional power there should be a reduction of subsidy". Indeed, he says, "this is already being studied ... the Government is thinking of reducing the subsidies for conventional power by increasing the price of the consumer bill."

But, says Jim Krane, the author of the DSG report and a member of the Electricity Policy Research Group at the Judge Business School at Cambridge University, if it's going to happen it will have to happen soon - and not just to give solar power a fair chance of having its day in the sun.

"Abu Dhabi has nuclear power coming online by 2018, but it's going to have a four- or five-year gap where it's not really sure where its feedstock and its power supplies are going to come from. So the Government is now agonising over this. Should it burn diesel fuel temporarily? Should it build a terminal and import liquid natural gas for a number of years before nuclear comes online? Or should it press its energy consumers to get them to lower consumption and reduce demand and squeeze out some extra time that way?"

When it comes to the environment, as speaker after speaker at Abu Dhabi's World Future Energy Summit reminded us this week, time is not the commodity it used to be, but as it starts to run out we are discovering all over again that the answer may have been staring us in the face all along.

"Sun power is now a fact and no longer in the 'beautiful possibility' stage," Frank Shuman told The New York Times in 1916. "We have proved the commercial profit of sun power and ... that after our stores of oil and coal are exhausted the human race can receive unlimited power from the rays of the sun."

His vision was engulfed by the rising tide of oil. Perhaps now, as that tide starts to recede, a technology that has languished in the shadows for generations will finally find its place in the sun - and a home in the deserts of Abu Dhabi.