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RSS solar projects purify water, heat and cool houses

Editor's note: This is the third in a series of four articles being published this month exploring the applications of solar energy in Jordan.

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AMMAN, March 23--Aqaba and Jbeiha are not the kind of places that come to mind when one thinks of 20th century technological breakthroughs in harnessing the immense power of the sun, but they may have to be added to the global roster of solar energy research centres in view of several pioneering projects now being carried out there by the Royal Scientific Society.

As the RSS campus in Jbehia, and at its experimental station for solar energy-powered desalination fo sea water in Aqaba, the solar energy unit of the RSS is starting to get into high gear in its research programme, which includes three main projects. These are the solar-powered desalination unit at Aqaba, solar water heaters for home use, and (the latest programme) investigation of the use of solar energy for both home heating and cooling.

The RSS's home water heating research is its oldest programme in solar power applications, but it will be discussed in the last article in this series, which will look into commercial applications of solar home heating and hot water provision along with the RSS's work in this area.

Most dramatic of the RSS programmes is the desalination work being done at Aqaba. After a year of testing an experimental station, the engineers at Aqaba have just moved into phase two of the research. This involves converting the desalination system into a two-stage process by the addition of a second condensation unit that has improved output of fresh water by over 50 per cent, according to RSS solar energy programme director Mohammad Qashou.

The technology being tested at Aqaba is the work of the West German company Dornier System, with whom the RSS is running the Aqaba experimental station as a joint venture.

The Aqaba programme is the first of its kind in the world to apply the principle of the heat pipe to desalination of water by using solar energy. The two-year experimental phase at Aqaba is designed to test and refine the equipment under severe operating conditions, such as using salty seawater. If the system works well under these conditions, Mr. Qashou told the Jordan Times, it will certainly work equally well in less trying conditions, such as sweetening brackish water in remote desert areas.

The system works on the principle that when sea water is heated sufficiently by passing through "heat pipes", that are heated to high temperatures by the sun, it will vaporise and then condensate on a cooler surface to leave sweet, drinkable water. The RSS engineers at Aqaba and at the RSS's Jbeiha headquarters are constantly testing different kinds of materials that will provide optimum results. The condensers now being used are made of mixture of copper, nickel and chrome. Aluminium pipes have also been tested at Aqaba.

The heat pipes themselves are made of aluminium, and can be manufactured in Jordan if the system is ever produced commercially here, for sale throughout the Middle East.

The RSS agreement with Dornier stipulates that each side will receive a certain share of the revenues if the system now being perfected goes into commercial production.

Mr. Qashou stresses that the aim of the programme is not research for its own sake, but achievement of an end use that will be of practical value to people in Jordan or the Middle East or the rest of the world, for that matter.

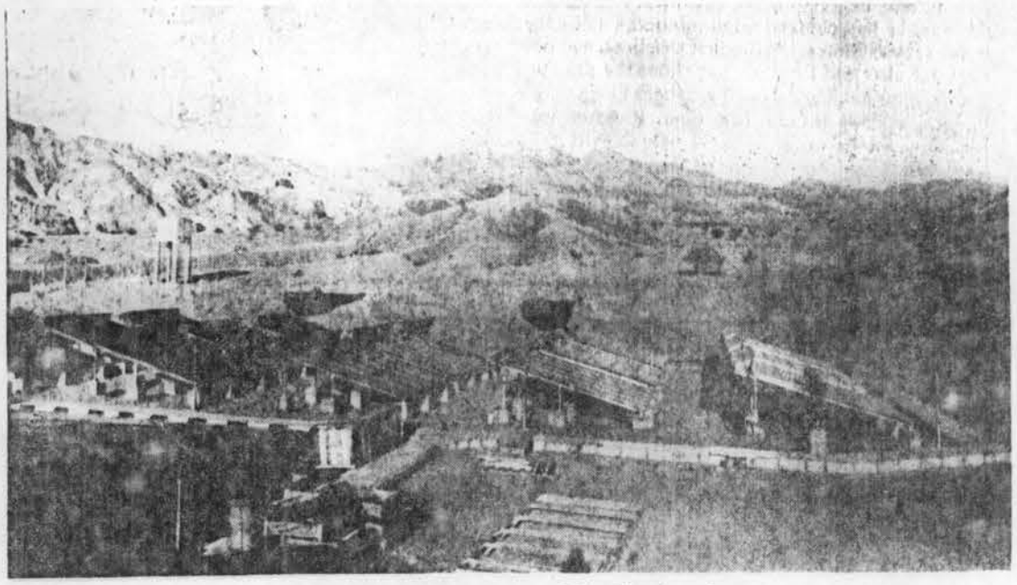
The system should produce four litres of fresh water per day per square metre of solar collecting surface, which level has nearly been reached at Aqaba. With the two-stage condensation process now being tried for the first time, output is expected to reach six litres per day.

Mr. Qashou says the system is best suited for small communities that do not have a source of freshwater but may be near sources of brackish water or seawater. With the great extent of coastal area throughout the Middle East, and the shortage of sufficient fresh water in this part of the world, the desalination system appears to have enormous potential in applications throughout the Middle East, but it will require until the end of this year to see what the final results of the experimental phase are.

The newest research effort of the RSS's solar energy unit is another two-year programme, being undertaken jointly with the Kuwait Institute for Scientific Research (KISR), to investigate the potential application of solar power for heating and cooling purposes.

According to Malek Kabariti, who heads the Jordanian side of the work, the research will concentrate on home applications of solar heating and cooling. Most of the cooling work will be done by KISR, with the Jordanian side investigating heating possibilities, though some research on solar-powered cooling units will be undertaken in Aqaba and the Ghor area of the Jordan Valley.

A 90 square metre experimental house is now being built at the RSS campus outside Amman



The RSS Aqaba solar-powered desalination plant

in which Mr. Kabariti will test the relative advantages of two kinds of solar-powered heating systems. One system uses circulating water as the heating vehicle, while the other uses hot air that is blown around through a system of ducts.

"We want to test and compare the two systems to discover which is best for Jordan," Mr. Kabariti says, "so we can avoid importing and imposing use of a foreign-made system that may not be best suited for conditions here. Our overall aim is to design a system that is practical for the Middle East and that can also be manufactured locally at minimum cost."

While heating homes by conventional hot water pipe and radiator systems is the most popular in Jordan these days, the use of water includes many problems, such as freezing, corrosion of pipes, leaking and boiling. The use of a hot air system circulated through ducts may be equally feasible, but it requires much testing. The hot air system would store heat absorbed from the sun's rays in a collection of ordinary black rocks.

The full-scale experiments in the concrete test house will start in the 1979-80 winter, but testing of the various sub-systems is already underway. To get the joint programme moving, Mr. Kabariti spent five months at the KISR headquarters last year coordinating definition of the precise information that the researchers want to derive from the two-year experimental phase.

The cooling systems that will be powered by the plentiful energy of the sun are of two kinds. The simpler one is known as a desert cooler, and is widely used in Iraq and parts of the southwest of the United States, where it is hot but dry. The desert cooler, which will be tested in Jordan on a limited scale, has a fan that blows air through a mesh of cloth material onto which water is dripped. The air blown through the mesh comes out into the room as humid air at a lower temperature than the room's air, because in passing through the moist mesh it has picked up the evaporating air inside the mesh that is cooler than the air inside the room.

The other system is more complex, and involves cooling entire homes or single rooms by using "absorbing cooling system". The RSS will test a lithium bromide water system in which lithium bromide acts as the absorber of water and heat. The system works on the following principle: water in which lithium bromide is dissolved is heated by the sun's energy to around 90° C, at which it evaporates and then condenses at high pressure. It is moved to a low pressure area where it evaporates again and in so doing it absorbs the room's heat. The vapour returns to be absorbed again by the lithium bromide which is reheated by the sun's energy to start the system moving around once again.

A different variation of the same system uses ammonia instead of lithium bromide as the absorber.

The potential for harnessing the plentiful energy of the sun to heat water or heat and cool homes in Jordan is virtually endless, given the plentiful year-round sunshine that is available here. Equally important to cahs-conscious research centres such as the RSS is the fact that a system that is perfected here will probably be applicable throughout much of the rest of the Middle East, meaning that commercial success is likely to follow technical breakthroughs.

The RSS itself, according to Mr. Qashou, does not plan to enter into commercial production of solar systems. When the RSS thinks it has perfected a system, it will look for a commercial investor to establish a manufacturing plant, with the RSS providing its know-how and technical specifications in return for compensation that would probably be worked out on the basis of securing royalties on sales.

There are several other smaller solar energy projects underway or planned at the RSS, including power generation by using solar cells, and thermal conversion systems that use solar-generated steam to power electricity generators.

A small solar pump is already working at the RSS headquarters and is also being adapted to pump sea water into the Aqaba desalination unit.

Another project being undertaken with the University of Jordan is the investigation of application of solar pumps to greenhouse-based agriculture.