Islands of nuclear power could green the deserts of the Mideast

by Marcia Merry

Israeli Foreign Minister Shimon Peres, in an interview with the Italian magazine *Acque & Terre* in April, suggested that nuclear energy could be "the most viable method for producing water by desalination," and spoke of regional agreements "to establish international islands on which the stations can be constructed under full supervision."

In fact, "islands" of electrical power, is the precise term used by nuclear engineers to describe how the modern installations, consisting of two or more modules of power units, should best be built. Innovations over the past 20 years have led to new designs for high-temperature, safe, modular power facilities that can be built, for example, assembly-line fashion in Europe, and then floated to the Mideast by seagoing barge, and finally installed "island by island" on sites perfect for desalinating the plentiful salt waters of the Israel-Jordan region. The nuclear power units are underground, allowing "walk-away" safety features in the event of any mishap. They can make use of safe thorium fuel pellets, with which Indian engineers have particular expertise.

The obvious prime locations are: 1) on the Gaza Strip, to provide power and to desalinate Mediterranean seawater; 2) along the long-proposed Mediterranean Sea-Dead Sea and Dead Sea-Red Sea canals; and 3) at points on a new Red Sea-Suez Canal cut.

The arid lands of the Jordan River Basin are so short of water for the 11.4 million residents of the area, that even the inauguration of the first "island" of power and water would add significantly to the per person and per hectare water-in-use ratios currently prevailing in this desert land.

Moreover, considering the simple fact that it takes 400 gallons of water (1.5 cubic meters) for quarrying one ton of gravel, any individual or agency that advocates housing or other construction projects, without also insisting on water and power infrastructure, is either incompetent or ill-intentioned, or both. If the funds were advanced today to construct simply the housing units and residential infrastructure needed in Gaza and Jericho and mandated by the new peace accords, the construction crews would have to wait, because while salt water can be substituted for many purposes, there is currently not enough usable fresh water available for all the tasks required.

It is urgent to break ground now on both the basic infrastructure—water and power—and the related social infrastructure of housing, hospitals, and schools. This is exactly opposite to the approach taken by such agencies and think-tanks as the World Bank and Harvard University, which do not recognize even the technology for nuclear-powered desalination. For example, look at Harvard's publication *International Security*, which this summer featured two articles on the lack of water in the Jordan Basin, appearing under the headline, "Will Blood Flow for H_2O?"

The following are some of the relevant factors of development for infrastructure in the region—water, power, and agriculture potential.

Desalination to end the water deficit

There are places in Israel and the Occupied Territories that have some of the lowest daily uses of personal water, as well as average per capita water use in the economy, of anywhere in the world. The average per capita consumption on the Gaza Strip for personal use is only 82 liters, and in some areas there and the West Bank, people have only 44 liters per day for all personal use—less than the minimum World Health Organization standard.

And yet, in the Jordan River Basin as a whole, all the available surface water is being drawn off, plus groundwater is being overpumped from the three aquifers west of the Jordan River at a rate causing increased salinity and depletion. The flow of the Jordan River itself has dropped from 1,200 million cubic meters per year discharge in the region south of Lake Tiberius (called the Lower Jordan River), to about 100 million cubic meters today, which makes it just a ditch.

Bringing on line a series of proposed nuclear-powered desalination plants, at strategic sites, will not only make up the water deficit now limiting essential economic activity, but will provide plentiful new supplies.

The two prominent designs are the modular high-temperature nuclear reactors proposed by Siemens and Asea Brown Boveri, and by General Atomics, based in California. In the

early 1980s, General Atomics worked out specifications for a proposed "island" installation of four modules to be located on the southern coast of California, to provide power for desalinating Pacific Ocean seawater, and at the same time, to provide electricity (see "Introduction to Nuclear Desalting: A New Perspective," by S. Golan et al., in *Fusion Technology,* December 1991). The physical setting is very similar to the Gaza Strip. If anything, the designs have been improved since the time of the early 1980s proposals, but the specifications are still relevant, and they are used here to illustrate what can be done right now in the Mideast.

Under the General Atomics proposal, a dual purpose desalination electricity plant would consist of four nuclear-fueled modules—each 350 megawatts, installed to provide power for a distillation system of saltwater desalination, which would provide a net volume of fresh water of 401,500 cubic meters per day (106 million gallons) and 466 MW net electrical power output.

Water and electricity gains

Look at what this means in terms of water and electricity gain.

On an annual basis, this one "island" of four nuclear modules would provide 146.5 million cubic meters of water per year. Just this one installation would provide more water than the current flow of the Lower Jordan River! The one "island" would provide more than the volume of water currently used by the 1 million Arab residents of the West Bank—125 million cubic meters a year—an amount fixed by Israeli government water officials in recent years.

It would take only four of these "islands" to provide water equal in volume to all the 650 million cubic meters currently used by residents of the West Bank, including Jerusalem and all settlements.

Twenty of these islands, over half of them located along the Mediterranean Sea-Dead Sea Canal, could provide 2,930 million cubic meters of water a year, which could more than double the current water availability for Israel, the Gaza Strip, the West Bank, and the Golan Heights, which together at present are using only about 2,500 million cubic meters.

Depending on the estimated length of the canal, which varies from 80 to 100 kilometers, according to the route selected (starting through or near the Gaza Strip and proceeding south of Beersheba, thence eastward), this would mean that 20 "islands" providing the water and power for development might be accommodated at intervals of about 4.5 kilometers (3.5 miles). Another plan would see 15 "islands," at larger average intervals, with another five "islands" located on the coast between Gaza and the Israeli border with Lebanon.

Each nuclear "island" would itself occupy an estimated 20 hectares (50 acres), making the surrounding area a potential oasis of new residential, industrial, agricultural, and cultural zones—a "nuplex," or nuclear-centered complex. Plus, the water and power could be channeled into the regional grids for use elsewhere to upgrade the existing communities. Each nuclear "island" would require an input of 1,263 cubic meters per minute (33,500 gallons) of salt water, which would figure in the final design for the exact dimensions and route of the canal channel.

The same approach applies to the Dead Sea-Red Sea Canal, whose route would extend approximately 150 kilometers through Jordan, terminating at the port of Aqaba on the Gulf of Aqaba. A third cut would be required in the vicinity of the outmoded Suez Canal.

The cases of Gaza and the West Bank

As each "island" came into operation, the water and power generated could provide the resources to conduct the next phase of improvements in the region. How to proceed involves development decisions to be jointly made by representatives of all those concerned. For example, look at the question of water for agriculture in two areas, the Gaza Strip and the West Bank.

The Gaza Strip has the classic arid, Mediterranean climate in which fruit and vegetable crops have been cultivated on the scale of 200 million tons of fruits and 100 million of tons of vegetables annually (in 1987). However, since that time, worsening water shortages, plus social despair and other factors, have seen a decline in output and output potential. Thousands of Arab residents of Gaza and the West Bank have abandoned agriculture and sought work commuting to Israel.

However, look again at the Gaza Strip. Its area (38,000 hectares) is about one-fourth the area of Philadelphia. At present, 800,000 people live in the Gaza Strip, one-half of them under 15 years of age. Rather than presume that new water resources should go into traditional irrigated agriculture, the portions of water over and above filling currently unmet needs, such as personal use and new construction, can go to high-technology agricultural methods such as hydroponics and aeroponics, where yields per unit volume of water, and per unit surface areas, are 10 to 50 times higher than for open-field farming—even with irrigation.

However, in the West Bank, there are an estimated 53,500 hectares that agronomists regard as handily ready for irrigation, requiring at least 200 million cubic meters per year. So at a later phase of installing the water and power "islands," the water of one new designated island (106 million cubic meters per year) might go to bring half of this acreage into open-field cultivation.

The electricity gains are in principle similar to the water gains. To indicate the overall dimensions, the net electricity provided by 20 international islands of nuclear-powered desalination plants, operating for the combined interests of Israel and the Palestinians, would add 9,320 MW of electricity capacity to the region, which, as of 1990, used about 17,491 gigawatt-hours of electricity.