Energy and water for the Mideast: the MHTGR

High-temperature gas-cooled reactors (HTGR) are an advanced form of nuclear fission reactor that originated as a spinoff of NASA's search for a nuclear propulsion system for manned missions to Mars in the 1960s, and prototype reactors have been operating for years at Fort St. Vrain, Colorado, and in the Federal Republic of Germany.

Designs are now forthcoming for modular reactors (MHTGRs) from General Atomics of California, and Siemens/Asea Brown Boveri of Germany. General Atomics proposes a standardized design for an HTGR module, able to produce 350 megawatts of thermal energy, which can be converted to about 140 MW of electricity. Asea Brown Boveri proposes small modules that can be "floated" into place on barges, and hitched with desalination facilities to cheaply produce fresh water.

The MHTGR uses helium gas as a coolant, instead of water. Since helium gas is inert, and has very low neutron absorption characteristics, the MHTGR is top of the line in design safety. Pipes, valves, and other metal reactor parts will not react with helium, virtually eliminating corrosion. The inability of helium to absorb neutrons means it cannot become radioactive, so problems with embrittlement and possible fatigue failure of metal parts are also eliminated. Moreover, since helium remains as a gas throughout the reactor cycle, there is no chance that the coolant will boil away; this also allows for visual television inspection of the inside of the reactor while in operation – something not possible during the steam phases of a water-cooled reactor.

MHTGRs for desalination

A study by the U.S. Department of Energy and the Metropolitan Water District of Southern California found that one single desalination plant, consisting of four 350 MW MHTGRs, could produce 106 million gallons of water per day, or 38.6 billion gallons per year, and provide at the same time, 466 MW of electric power each as well. There are also designs for smaller units, easily mass-produced.

A unique advantage of high-temperature gas-cooled reactors is that their energy can be used as process heat or steam. Seventy percent of industry's energy needs are of this type. With the advantage of MHTGRs' flexibility in siting, they can be located strategically where they can provide water, electricity, and process heat for industry all at the same time.

June 1992, "The days to come and the months to come would probably witness a dialogue over a project like this [Dead Sea Canal] in the multilateral talks, and see how best that level of the Dead Sea be controlled."

Through these and related projects, significant improvements in the water supply of the Middle East and North African nations could be realized within a few years, with dramatic improvements accruing by the turn of the century.

Man-made rivers and lakes

It is crucial that the water flows thus generated not be dispersed in an arbitrary manner, but be organized and concentrated in what could best be described as a "network of man-made rivers and lakes." Water from the Mediterranean, Red Sea, Persian Gulf, and Arabian Sea can be channeled via canals into a series of artificial reservoirs.

Where necessary, water must first be raised through pumping to points from which the water can then flow to reservoirs via canals. The power for this can be supplied by nuclear reactors. Where the creation of canals and reservoir basins requires large earth-moving operations, nuclear excavation can be employed with advantage.

Canals provide both the water flow to fill the reservoirs, and also a transport means. Along the canals and reservoirs we can construct "nuplexes" – complexes of nuclear power and large desalination units, generating fresh water for a system of smaller and larger freshwater canals ("artificial rivers"). Large-scale use of desalination is complemented by channeling and pumping of fresh water from natural sources.

Instead of simply spreading the fresh water around evenly in an irrigation system, we can create with these rivers a network of interconnected "green bands" of development. As opposed to merely isolated "green islands," these green bands become at the same time transportation axes for the movement of goods and persons by ship, rail, and road, and the locations for new towns, cities, and industrial complexes.

The locations and courses of the new rivers and "green bands" must be determined on the basis of geographical, geological, and infrastructural considerations, bearing in mind the future growth of population and transport as well as the regime of water flows which will arise through increase in natural rainfall.

The reservoirs of salt water channeled inland from the seas will serve several purposes. First, they supply the desalination plants and various industries along their shores. Second, they provide a means of transport, together with the canals. Third, the water from these lakes enhances the water cycle of the atmosphere; and there are potential hydrostatic