III. Economics

Oasis Plan Conference

Jordan Can Be a Starting Place—Thorium Reactors for Plentiful Power and Water

by William DeOreo

The following is an edited transcript of the presentation by Colorado, U.S.-based hydrologist William DeOreo, President of Aquacraft, Inc., and proponent of nuclear desalination, to Panel 2 of the April 13, 2024 conference of the Schiller Institute, "The Oasis Plan: The LaRouche Solution for Peace Through Development between Israel and Palestine and for All of Southwest Asia." The second panel of the conference, "The Physical Foundation for the Economic Development of Southwest Asia," was moderated by Stephan Ossenkopp, Schiller Institute-Germany.

Fellow panelists with Dr. DeOreo: Keynote speaker, Jason Ross, Science Adviser to the Schiller Institute-U.S.; Ilya Andreev, First Secretary and Expert in Humanitarian Affairs, Russian Federation Mission to the United Nations; Dr. Pierre Berthelot, Associate Researcher at IPSE, member of the Académie de l'Eau, and Director of the journal Orients Stratégiques; *Dr. Kelvin Kemm, nuclear physicist, former Chairman, South African Nuclear Energy Corporation; and Dr. Izzeldin Abuelish, a Palestinian physician, professor, author, and peace activist living in Canada, who gave a pre-recorded statement.*

An article summarizing the conference, and an 80-minute video of the highlights of the day-long event, are available here.

Schiller Institute

William DeOreo, president of Aquacraft, Inc.

April 13—Having listened to the presentations from 9 o'clock this morning our time to now, I'm just struck by the notion of a group of people watching a burning building, and people saying, "Let's put some water on this building, let's start the fire hoses." And one group says, "Well, maybe we ought to find the people who started the fire, and make them put the water on the building."

But I think from our perspective—scientists and engineers—we're most interested in getting the fire put out first. We can deal with the other things later. I'm firmly of the belief that a technical and economic solution can be the basis of a political solution, where it's often very difficult to come to a political solution, because the degree of passion and injury is so immense that it makes it very difficult. But we can start small.

CC/Makeandtoss

Map of Jordan showing proposed pipeline for moving desalinated water from Aqaba to Jordan and the West Bank.

So, one of the things is that in 2015 our company did a water study for the Kingdom of Jordan. During that study, I got into conflict with the agency that was sponsoring it, because they expected us to find ways to keep the people from getting the water that they needed, in order to limit the demand to what the supply was. I kept arguing that what we really need to do is, we need to increase the supply to provide Jordan with the water that they need in order to have an advanced society. You cannot force people into a permanent state of deficit, shortages; it just doesn't work.

Thorium Reactor

One of the technical solutions that I have been long in favor of, is a type of nuclear reactor that runs on the thorium cycle. It is cooled by molten salt, not water. It operates at a very high temperature. With these reactors, you can generate electricity and use the waste heat from the reactor to desalinate water.

Other speakers have alluded to this, that in the [Lyndon] Johnson [administration] plan during the 1960s, the United States really tried making a breakthrough in nuclear technologies at a place called Oak Ridge, Tennessee, under the direction of Dr. Alvin Weinberg, who developed a technology for using thorium to generate electricity.

Without getting into all the details, thorium is a technology that is inherently a safer and less militaristically embedded technology. It does not create the same kind of problems with proliferation; it does not even require enrichment of uranium. It's a fundamentally different kind of technology.

But because it was so different, and because it did not generate fuel for bombs, the system was scrapped by the Department of Defense in favor of technologies that generated plutonium. So, the nuclear development was basically hijacked in the '60s. I will just read this one little statement from Dr. Weinberg:

> The first nuclear era is over. Let us plan for a second nuclear era based on a new and more rational technology.

This was written in 1973. What was meant by that was that the technology that we had developed was basically a weapons technology with a little bit of civilian goodies attached to it. What we need is to rethink the way we do this, and to build an inherently peaceful nuclear technology.

In the Middle East, in Jordan, I don't know if you remember—it seems like so long ago—but the Syrian revolt that happened in Dara'a, Syria; do you remember that? That revolt was like an attempt to overthrow the regime of the government of Syria, the Assad government. But that began with a group of farmers who lost their irrigation rights. Their wells were shut down, so they were forced from being productive and fairly self-sufficient farmers and agriculture people, into living in Dara'a as poverty-stricken street people. The children went out and started writing graffiti on the walls, complaining about their situation. Remember, these kids were arrested; I think a couple of them were killed. It began the entire revolt. It all came down to the fact that they lost their water and they lost their ability to be self-sufficient.

Water for Jordan

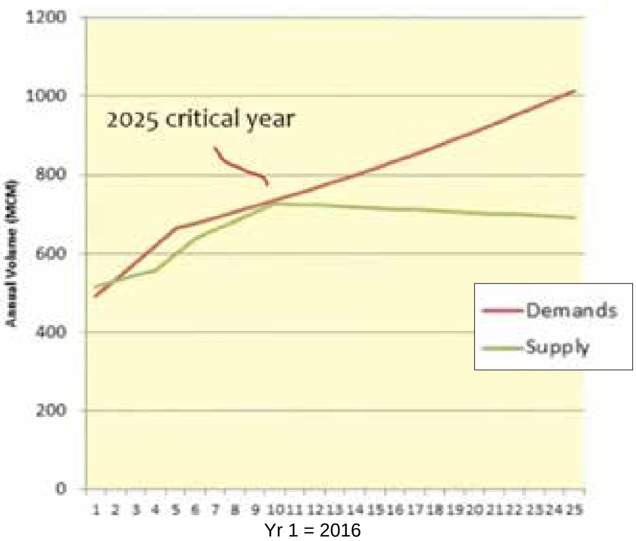
In this map of Jordan—of course I've worked in Jordan, I'm familiar with Jordan. There are several advantages that Jordan has in solving the Middle East problem. One, it has access to the Red Sea at Aqaba. What we had proposed—there's been discussion about the Red Sea-Dead Sea project, which is basically building large canals and using gravity to flow water into the Dead Sea and to generate electricity. That, it is my understanding, has reached kind of an impasse because of problems with the amount of water going into the Red Sea and effects it would have on the ecology of the Red Sea.

Our concept was that you would bring—there are companies that would make nuclear reactors on barges. One is a company called Thorcon, and there's Copenhagen Atomics. You can bring these modular reactors in by barge up the Red Sea and establish a site in Aqaba, where you would desalinate water and generate electricity. The brine from that water would be returned back to the Red Sea, or put out into evaporation basins, whatever. It's a 300-km pipeline between Aqaba and Amman. Then, you would start by developing water and power around Aqaba and let the system spread to the north as more and more land became irrigable, there was more production, there was inexpensive electricity. You let the system pay for itself as it developed.

So you don't need a huge international consortium, and you don't require the Israelis to come to peace with the Palestinians. It can all be done in a relatively stable political situation with one country involved; it would all be done in Jordan. Of course, here's the West Bank. Water from this system could be used to supply the West Bank; it could be used to bring water over to Gaza, which would give the Palestinians their own independent supply of water and power without requiring them to come to what may be a very difficult political solution with Israel.

That is the very concept there. Jordan is one of the last refuges in the Middle East. It has absorbed a lot of refugees from Palestine, Iraq, and Syria. The population now is close to twice what was planned, because of the

Water Demands and Supplies in Jordan



Aquacraft, Inc.

Actual and projected water demands and supplies in Jordan, in millions of cubic meters per annum.

influx of refugees. The water supplies cannot keep up with this. Power supplies are horribly inadequate as well. Jordan has no oil or gas and must import all of its fuels. That makes them a prime candidate for this project.

Here is a graph that we prepared. This red line is not the actual supply of water; it's what we estimate is required, as a minimum, to supply an advanced economy in Jordan. The first year is 2016, so, over the 25 years since 2016, it would be up to 2040.This is the amount of water we think is necessary. The green line is the amount that is available from all the existing supplies in 2016. Unfortunately, it includes the Red-Dead project, which so far is at a standstill. You see that, starting at about 2025, even with the Red-Dead project and the various aquifer projects, the supply begins to diminish because of groundwater depletion. So the situation is going to get worse over the next 25 years if we don't do something. The natural supplies just are not enough to get it done.

Desalination, Plentiful Water

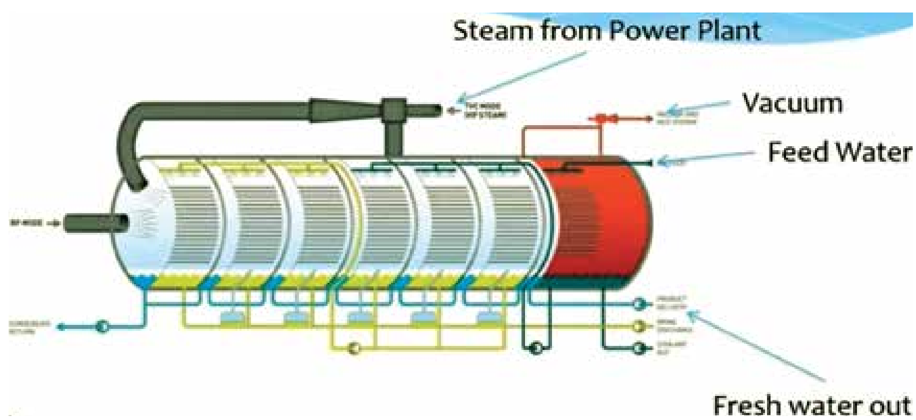
Here is a diagram of a thing called a multiple-effect desalinator. It does not run on electricity; it runs on heat. Basically, the salt water supply comes in on this [top] side, and the steam is condensed and you create fresh water out of the bottom of the system. You can operate this thing with really low—from the standpoint of energy production—a low-grade heat. It doesn't even have to be steam. It can be 180 degrees Fahrenheit. These thermal desalination units can use heat that would otherwise be wasted, and generate fresh water.

Kind of a rule-of-thumb is that for every 100 MW of electrical output from your power plant, you can generate 10 million gallons a day, which is about 40 million liters a day of fresh water. So, a 100 MW plant like this in Abu Dhabi in the United Arab Emirates, they're producing 400 million gallons of water a day from an output of 4.6 GW of electricity. In Abu Dhabi, they're doing this with natural gas. I think the Emirates is seeing the handwriting on the wall, too, because they are also studying switching over to nuclear power. Every bit of water in Abu Dhabi—basically, it's a large city—it's all run on desalinated water and all on natural gas. They could switch that over to nuclear and just keep going indefinitely.

In a typical 24-hour period, the electrical demand will rise and fall. You can take your power plant and run it at its peak efficiency, and then, when the electrical demand is down during the early morning and night, you can generate more fresh water, which is a very efficient way of doing this—a very good idea.

Molten salt reactors are ideally suited to this technology, because they operate at high temperatures. They're cooled with molten salt, which melts at 700 degrees Centigrade and doesn't boil for several thousand degrees. It's a huge liquid range. So they are inherently stable, they don't require water for cooling, they're passively safe. You can turn them off. At Oak Ridge, when they were running one in the '60s, they would turn it off on the weekends. The heat from the reactor goes into a secondary heat exchanger where it generates steam, which can be used for water and

MED Thermal Desalination



Aquacraft, Inc.

A multiple-effect desalinator (MED). It runs on heat, not electricity.

Aquacraft, Inc.

Al-Taweelah Plant in Abu Dhabi.

power generation. The only water that is required is make-up for the boiler, because if you're running a steam boiler, you obviously need some make-up. But that could come from your desalinated water. So it's a great application for a desert country.

The economics of the system, at least when we looked at it a few years ago: A 1000 MW power plant would generate 6.3 million MWh of electricity at a reasonable retail rate that would generate, between the water and power, $850 million a year. But the capital costs, including construction and capital recovery are about half of that. So it would also generate 137 million cubic meters of water a day, which I think would almost double Jordan's fresh water supply, from a single plant. It would have a benefit cost ratio of 1.8 to 1, which is hard to beat.

Light a Fire Under the U.S.

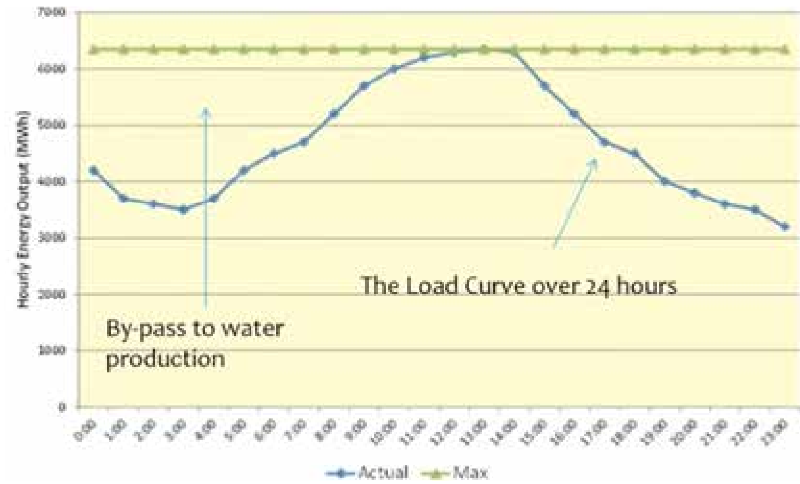
That's what I have to share with you. I can just say that it's interesting—one of the frustrations I've had in getting the United States government to pay attention to this is that there's not a lot of interest. The United States has fallen into this regulatory malaise where the function of government is to stop innovation, and to regulate everything to death.

One of the nice things about the BRICS nations is that they are an independent governmental source. Right now, the U.S. is not working on molten salt reactors, except for a few small private companies. This development is slow, and it's poorly funded. The Department of Energy is not actively promoting this development. They kind of take this hands-off approach, but they ensure that nothing happens, because they have their hands on the regulatory levers, which prevents companies from doing any productive work.

A tremendous amount of work is being done in Canada, China, and India. From our perspective this is great, because these countries can actually—I know the Chinese got a lot of information from Oak Ridge, and they said, 'this is wonderful, we're going to go and build these,' one of these molten salt thorium breeder reactors, which, I believe, they've either got one very close to coming online, or it might already be online; it's hard to say. But I know they've been working on it. Remember in the '60s the idea of the missile gap? Everyone was worried about the Russians having more missiles than the United States. So, maybe we can also light the fire under the U.S. with the thorium-reactor gap. That would be a way to get things going.

But I would advocate an international effort for all countries to share technology and to develop the thorium breeder reactor. There are 106 million tons of known thorium on the planet. Every ounce of thorium can be used to fuel a nuclear reactor. These reactors do not generate waste; they generate valuable isotope byproducts. It really would be a game-changer in human development. Basically, an almost inexhaustible supply of energy, which could be used anywhere on the planet to develop local economies. Jordan and the Middle East would be a great place to start.

Thermal Desalination Can Optimize Power Plant Operation



Aquacraft, Inc.

Heat from the power plant can run desalinators at night and in the early morning, when the demand for electricity is low.