Nuplexes can provide energy, process heat for the rapid industrialization of Egypt

by Jon Gilbertson, Director of Nuclear Engineering, Fusion Energy Foundation

On Nov. 24, an ambitious program developed by *Executive Intelligence Review* and the Fusion Energy Foundation, outlining how U.S.-Egyptian cooperation in the development of thermonuclear power for electrical energy in Egypt is the cornerstone of a comprehensive Middle East stability plan, was released by Lyndon H. LaRouche, Jr. and the National Democratic Policy Committee (NDPC), whose advisory board he chairs.

The program was commissioned after the Oct. 6 assassination of Egypt's president Anwar Sadat, as an urgent measure to underline American commitment to Egyptian economic growth. Continued progress in Egypt and the entire region is dependent on universal access to nuclear energy. The rapid conclusion of current talks between Washington and Cairo on delivering advanced nuclear technology to Egypt is an essential response to the Dark Ages perspective of Sadat's Muslim Brotherhood assassins. The Muslim Brotherhood is committed to replicating the barbarism of Ayatollah Khomeini's Iran throughout the Middle East. Allowing Egypt, the dominant population and scientific center of the region, to follow Iran would mean disaster for the entire so-called Arc of Crisis stretching from northwest Africa through the Persian Gulf and the Indian subcontinent.

The program proposes a sweeping national development effort by Egypt, centered in the construction of "nuplex" urban centers built around new nuclear power plants. Egypt could achieve in 30 years a living standard on the level of the industrialized West for an expanded population of perhaps 65 million.

The passage of President Reagan's proposal to sell AWACS radar planes to Saudi Arabia puts the potential for Arab-American cooperation at the highest point in years, and the Japanese and West Germans are ready to join in a major effort for development in the Middle East. The Saudi peace plan sponsored by Crown Prince Fahd raises the promise for a comprehensive Arab-Israeli settlement, making peace in the Middle East within reach.

A nuclear-based agricultural and industrial development program for Egypt

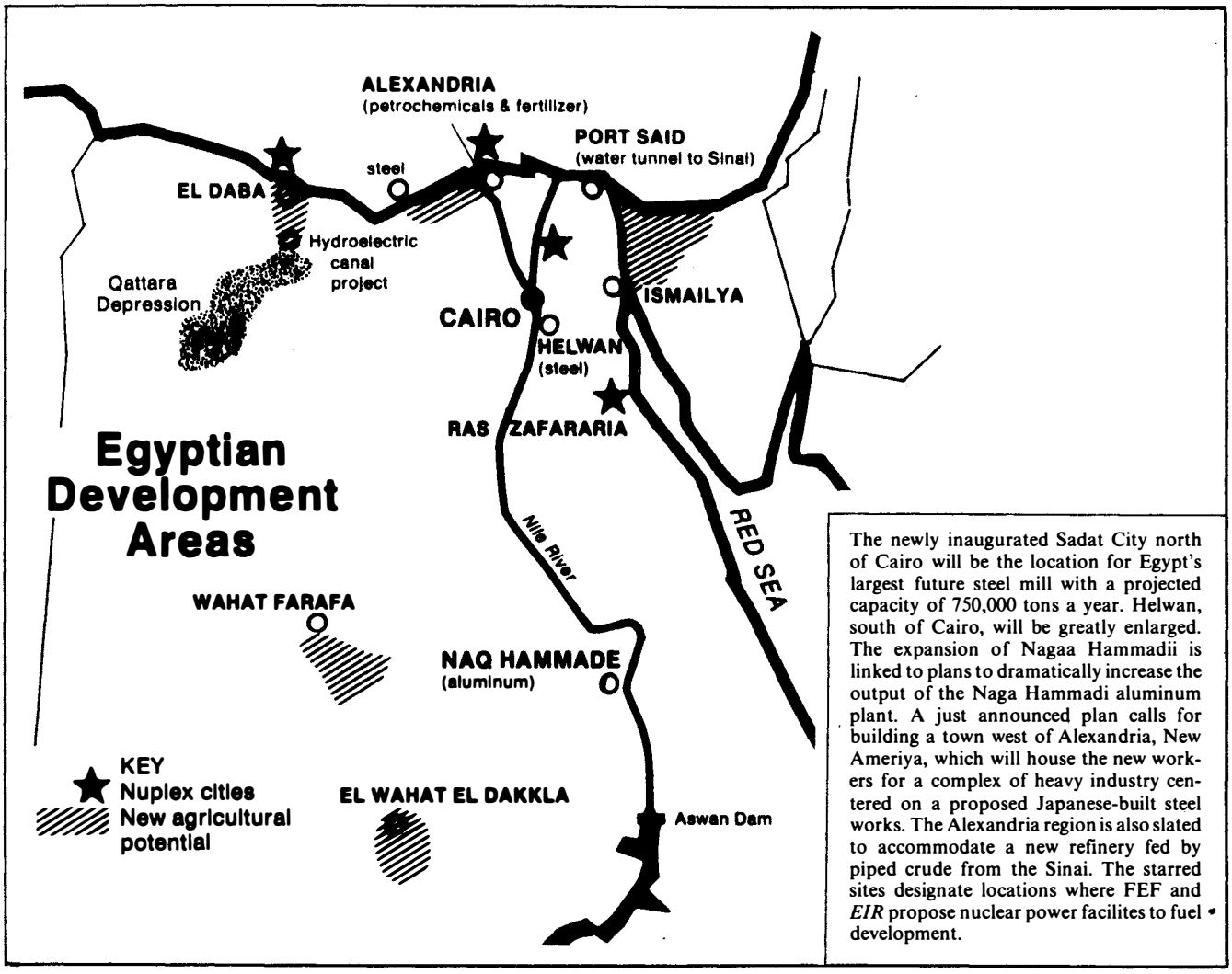
In order to initiate rapid development in the Middle East and North Africa, large amounts of nuclear energy must be introduced as quickly as possible.

State-of-the-art nuclear power reactors—such as pressurized boiling water or heavy water reactors—must be constructed in existing or planned Egyptian urban and industrial centers as part of integrated nuclear-centered agro-industrial complexes ("nuplexes"). Financing packages must be put together by the reactor-manufacturing nations, the U.S., France, Germany, and Japan. In the United States, this means increasing the export financing subsidies and lowering the interest rates of the Export-Import Bank and relaxing the export restrictions now demanded under the U.S. Nuclear Non-Proliferation Act of 1978. Loans to Egypt from other oil-producing nations, such as Saudi Arabia, should play a critical role.

For nearly 20 years, the principal design concept for introducing nuclear power into the developing sector has been the nuplex. Although designs for such installations have been on the drawing boards for years for India, Mexico and the Middle East, none have been built.

The nuplex conception is to apply nuclear power plants in a multi-phased agro-industrial development program. In the first phase, existing water-reactor technologies supply power as the center of an integrated agro-industrial complex, surrounded by residential areas and farmland. Nuclear electricity production frees the area from the confines and bottlenecks of an "umbilical cord" tied to usually distant coal or petroleum resources.

The second development phase applies new reactor technologies now under development to use nuclear power plants as sources not only of electrical power but also of high-quality, high-temperature industrial process heat. The production of cement, fertilizers, iron,



The newly inaugurated Sadat City north of Cairo will be the location for Egypt's largest future steel mill with a projected capacity of 750,000 tons a year. Helwan, south of Cairo, will be greatly enlarged. The expansion of Nagaa Hammadii is linked to plans to dramatically increase the output of the Naga Hammadi aluminum plant. A just announced plan calls for building a town west of Alexandria, New Ameriya, which will house the new workers for a complex of heavy industry centered on a proposed Japanese-built steel works. The Alexandria region is also slated to accommodate a new refinery fed by piped crude from the Sinai. The starred sites designate locations where FEF and *EIR* propose nuclear power facilites to fuel development.

Courtesy of *New Solidarity*

and other basic metals, synthetic fuels, and many other chemical processes involves tremendous amounts of direct heat input.

This direct heat, usually referred to as process heat, is required at different temperatures depending on the process; the higher the temperature, the more efficient is the utilization. Therefore, in order to make a nuplex highly efficient and thus extremely economical, a nuclear reactor should be capable of supplying process heat at high temperatures. The reactor best suited for this is the High Temperature Gas-Cooled Reactor (HTGR).

Further program phases applying advanced breeder reactors, for example, begin as such advanced technologies come on line.

If nearly all the energy from a nuclear reactor can be used productively, instead of just 30 to 40 percent as is now the case for electricity production, the cost will plummet and the overall productivity effect on the economy will soar. Although the capital investment required to put together a nuplex project is obviously very large, the pay-off will also be very large because of much-reduced operating costs. Taking the dense, concentrated energy produced from an HTGR, and distributing it to industrial processes and manufacturing plants in the vicinity of the reactor, will provide a unique step-up in a nation's economic output and therefore its living standard.

It will take thousands of people to support and operate the integrated industrial processing centers created by the nuplex. Thus, the construction of cities as an integrated part of such facilities is a key consideration in developing future nuplexes.

Energy growth rates

The goal of Egypt's energy plan will be to achieve a Western European energy density per person within a 35 to 40 year time frame. This will mean increasing Egypt's total energy consumption per capita from the current 3770 KW-hours to the present average Western European consumption of 35,100 KW-hours by the year 2020, an increase of over nine times current levels. Furthermore, since electrification is a vital energy input

into the development and modernization of a nation, a simultaneous goal will be to convert nearly 37 percent of this energy consumption into electricity, again approximately the present Western European level.

Since it is extremely important to use Egypt's reserves of oil, natural gas, and coal for direct applications in industrial and agricultural production, such as steel, fertilizer, petro-chemicals and gasoline/diesel fuel, as well as for export, they should be used as little as possible for producing electricity. All electricity production should be based on nuclear energy and, where possible, hydro-electric projects; since the development of additional Egyptian hydro-electricity is limited, this means most future electricity will be nuclear-generated.

The total energy consumption in Egypt in the year 2020, taking into account this per capital goal and an expected population of about 90 million, is 362 GWt (Gigawatts thermal). Current total energy consumption (using 1978 data) based on approximately 40 million people is only 17.5 GWt. This means that total energy consumption (using 1978 data) based on approximately 40 million people is only 17.5 GWt. This means that total energy consumption must increase by over 20 times today's level. Of this total energy goal, 135 GWt must be used to produce electrical energy, meeting the goal of approximately 46 GWe (Gigawatt electric) consumed per year by 2020, assuming a thermal-to-electricity conversion efficiency rate of 35 percent.

Growth rates for electricity production are assumed to be somewhat higher than the total energy growth rate because of the former's importance in accelerating a nation's development. Between now and 1990, a 7 percent annual electricity growth rate is planned, while during the next decade through the year 2000, a 10 percent rate will be achieved. For the following two decades, the annual growth of electricity consumption will level off at about 8 percent. In order to produce the required amount of electricity, twice as much generating capacity must be installed, based on projected load factors for Europe and the United States.

Thus, using these growth rates and the capacity factor of 0.5, the electrical generating capacity will increase as follows: 3.2 GWe; 1990: 7.2 GWe; 2000: 18.7GWe; 2010: 42.0 GWe and 2020: 92 GWe.

Total energy growth begins with an average rate of 5 percent from now until 1990, and increasing to 8 percent in the last decade of this century. Between the year 2000 and 2010 an annual rate of 10 percent will be attained, dropping off again to 8 percent through 2020. Thus the total energy consumed in Egypt over this planning perod will increase as follows: 1980: 17.5 GWt; 1990 31 GWt; 2000: 67 GWt; 2010: 173 GWt and 2020: 362 GWt. Over one-third of this thermal energy is converted to electricity, and this ratio will continue to increase upwards of two-thirds by 2050. The remainder of thermal energy is to be used in direct applications, such as for fuel oil, gasoline, and industrial process heat.

Eighty to 85 GWe is to be provided by nuclear energy. A small amount of fossil-fuel-produced electricity is not expected to exceed 2 GWe total, and there will be a few GWe of hydro-electricity, inclding the Aswan Dam's full capacity of 2 GWe. Contributions from both these sources are not expected to exceed approximately 10 GWe by 2020.

How Oak Ridge began Mideast nuplex plans

by Robert Gallagher

The concept of the nuclear-centered agro-industrial complex ("nuplex") was originated by the scientists and statesmen who formulated President Eisenhower's 1953 Atoms for Peace program. The mid-50s Strauss-Eisenhower plan, named for the President and the first chairman of the Atomic Energy Commission, Adm. Lewis Strauss, called for construction of a nuplex in the Sinai-Negev area of the southeastern Mediterranean coast to be jointly owned and managed by Israel and Egypt.

In 1964, Oak Ridge National Laboratory set to working out the details of the nuplex idea for the Middle East and the entire developing sector of the world economy. Its efforts were spurred by the U.S. Senate's unanimous adoption of Senate Resolution 155, introduced in December 1967 by Senator Howard Baker. The resolution called for building peace in the Middle East through economic development centered around nuclear-based agricultural centers, whose waters would be provided by nuclear desalination plants.

> It is the sense of the Senate that the prompt design, construction and operation of nuclear desalting plants will provide large quantities of fresh water to both Arab and Israeli territories and thereby will result in: 1) new jobs for the many refugees; 2) an enormous increase in the agricultural productivity of existing wastelands; 3) a broad base for cooperation between the Israeli and Arab government(s); and 4) a further demonstration of the United States efforts to find peaceful solutions to areas of conflict.

The Oak Ridge scientists, led by Lab director Alvin M. Weinberg, approached their design studies by posing the question: "How can we most quickly bring the developing countries up to the standard of living of the

advanced sector?" Their purpose and motivation was perfectly clear:

> (Nuplexes) would provide developing countries a means of combating the imminent food shortages as well as providing a means of "leapfrogging" in their development.[1]
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> The time has come when the energy derived from nuclear energy can be looked upon very seriously as a key for releasing indigenous agriculture from the bondage imposed by the necessity of securing fuel, fertilizer, and power for tillage all directly from the land without energy resources from the outside. . . . Such inputs could free these peoples from the Malthusian limitations hitherto imposed upon their indigenous food supply. . . .[2]

The Oak Ridge team developed detailed economic blueprints for some 26 nuplex sites around the world. Central to their application of nuclear power to developing sector agriculture was the use of power-intensive processes to obviate the need for raw materials such as naphtha and sulfur for fertilizer production. They also produced designs for nuplex-based production of magnesium, acetylene, aluminum, and many other products; special emphasis was devoted to nuplex steel-making.

The agricultural section of Oak Ridge's main conceptual study takes the Strauss-Eisenhower Sinai-Negev site as an exemplary design for a "food factory" that, depending on crop mixture and patterns, could support between 4.5 and 6.2 million persons, at a cost no greater than 9 cents per day per person in 1967. Water usage per person for this food factory would be equivalent to per person wate usage in New York City. The study details water usage, yields, food value, and efficiency for some 10 crops and three principal crop mixes. The team rigorously calculated internal rates of return for both agricultural and industrial production, which demonstrated that the nuplexes would make a profit as high as 19 percent and that the vast Egyptian domestic market was ideal for assimilating nuplex agricultural goods.

A central feature of the Oak Ridge program was to apply nuclear-based desalination to provide irrigation water and reclaim first coastal, then inland, deserts throughout the developing sector—directly following the model of America's own development.

> A third of the world's land is dry and virtually unoccupied, while half of the world's people are jammed—impoverished and undernourished—into a tenth of the land area. . . . [T]he fastest-growing region in our own country is the southwest desert, into which Americans move happily, taking their water and power requirements with them. . . . [N]uclear energy—not tied by any "umbilical cord" to coal or petroleum deposits—will play a significant role in opening up arid areas for human living space.[3]

A central feature was the expansion of educational institutions to train the skilled labor required to run the nuplexes after a period of transition. They saw that the nuplex would have to be prepared for the introduction of revolutionary new technologies at least every 15 years. They projected a two-phase nuplex program, the first based on light-water reactors and the second on advanced nuclear-fuel breeder reactors. Due to the stagnation of advanced-sector industrial development, virtually the same technologies that were on the drawing boards during the studies are still there today.

[1] "Nuclear Energy Centers: Industrial and Agro-Industrial Complexes," ORNL-4290. Oak Ridge National Laboratory, November 1968.

[2] Perry R. South, Potential Agricultural Production from Nuclear-Powered Agro-Industrial Complexes Designed for the upper Indo-Gangetic Plain," ORNL-4292. Oak Ridge National Laboratory, November 1968.

[3] "Nuclear Energy Centers: Industrial and Agro-Industrial Complexes: Summary Report," ORNL-4291. Oak Ridge National Laboratory, July 1968.

Egypt's current program for economic growth

The centerpiece of the current Egyptian development strategy as defined by the revolving five-year plan is the construction of eight 9We (gigawatt electrical) light water nuclear plants for power generation by the year 2000. The Egyptian Electricity Ministry is expected to begin taking bids for the first two plants in 1982. Over the past 12 months Egypt has signed agreements with the governments of the United States, France, Britain and West Germany to allow for the transfer of nuclear technology to Egypt.

According to projections from the Egyptian government, the eight plants will provide roughly half of the electricity demand by the year 2000. There are three sites for the plants, each site projected to handle up to four plants. Sidi Krier, 20 kilometers west of Alexandria, El Daba, 150 kilometers east of Alexandria (both on the Mediterranean), and Ras Zafararia, about 150 kilometers south of Suez on the Gulf of Suez, have been selected as sites.

El Daba will be the first to see nuclear plant construction, projected by the Cairo government to begin in 1983. Two plants are slated to be built there, to help power New Ameriya, a new city to be built west of Alexandria, and to supply electricity to a new ultra-high-technology integrated steel facility using the direct reduction process with Egyptian natural gas from the Abu Qir gas field.

Egypt's determination to acquire nuclear generating

plants stems from a power crisis, exacerbated by what the Ministry of Electricity estimates to be a net fifteen percent annual growth in demand for power.

Between 1980 and 1990, Cairo aims to increase Egypt's electricity output from the current 4,500 megawatts to 10,000. Aside from bringing on line nuclear plants and smaller conventional projects such as the construction of the 270 megawatt Aswan II power plant, the Cairo regime continues to study prospects for a massive hydroelectric project to flood the Qattara Depression in the western desert about 150 kilometers south of the Mediterranean coast.

Heavy industry features decisively in Egypt's future development plans; expanding Egypt's steel producing capacity is a priority. At present Egypt can produce about 1.7 million tons a year of steel, roughly 75 percent of which comes from the giant Soviet-built Helwan steel complex just south of Cairo. The Egyptian government aims to double output through the construction of two new steel complexes at Al Dekheila and at the proposed new town of Sadat City north of Cairo.

Another facet of Egypt's basic industrial strategy is the expansion of the Nag Hammadi aluminum smelter about 500 kilometers south of Cairo on the Nile. By 1982, the plant will produce 166,000 tons of aluminum per year.

The projections of increased steel and aluminum output intersect plans for construction of new cities to provide the workforce for these industries, and to stimulate new areas of economic growth. Egypt's city-building plans center around relocating population out of overcrowded Cairo and Alexandria.

The largest city-building project, inaugurated late last year, is construction of Sadat City between Cairo and Alexandria, slated to be a heavy-industry site beginning with the above-mentioned steel mill. It will provide homes for well over a million Egyptians. With the enlargement of the Halwan steel complex, the Egyptian development plan also calls for construction of the new city, 15 May City, near Helwan.

Another constraining factor on accelerated development in Egypt is its limited port capacity. At present Cairo has put priority on projects to expand port capacity in the Alexandria region. With a mere 5-million-ton annual capacity, the Alexandria port is currently straining to handle up to 20 million tons a year, and imports through Alexandria continue to increase.

The Alexandria region may well become the center of a new refining and fertilizer production center, since petroleum is piped from the Sinai into that region. The Egyptian development plan foresees integrating nuclear plants on the Mediterranean with the installation of desalination plants to expedite such land reclamation projects and expand Egyptian agriculture beyond the confines of the Nile River.

AID: the chief barrier

An executive with a large U.S. company told *Executive Intelligence Review* that his firm had sent a letter to the White House urging that the United States supply nuclear plants to Egypt as a matter of urgent national security. "If the U.S. is not part of Egypt's nuclear energy program, there is absolutely no guarantee that Egypt won't find itself in the same position that Iraq did," declared the source. "The Arabs know that a nuclear facility built by, say, a European country which exerts little influence in the Middle East compared to the U.S., is no security at all." Israeli destruction of facilities in Egypt, the closest U.S. ally among Arab nations, would mean a violent diplomatic break with Washington.

Under a high-interest rate regime, the private sector cannot independently finance the $1 billion-plus cost of nuclear plants for Egypt. The traditional source for credit support, the Export-Import Bank, is currently being financially straitjacketed by William Draper III, whose father founded the genocidal Population Crisis Committee, which had a hand in writing Global 2000, along with AID.

The only other government agency which could augment financing of U.S. nuclear technology exports to Egypt is AID itself. At present AID grants to Egypt approach close to $1 billion a year, larger than the rest of AID's total grants to the developing sector. But, according to AID's founding guidelines, it *cannot fundamentally underwrite* the transfer of nuclear technology, even for peaceful purposes, to any developing nation.

Instead, as AID's massive program in Egypt illustrates, the agency promotes economic policies based on the Hong Kong "free-market" model, and decentralized, small-scale labor-intensive rural programs. American businessmen attempting to engage in industrial agreements with Egypt have complained about the role of AID's Cairo mission director, Donald Brown, in sabotaging such deals.

An official with the State Department's Near East Desk on Environmental Affairs who works closely with the AID division was adamant that "never in a million years will AID support nuclear exports to Egypt or any other country. "If the President told AID to use the $750 million slated for Egypt next year to go towards nuclear plants, AID would resist; this is not AID's image. But I'm really not worried about it. It is true that Reagan would like to sell the plants to Egypt and the nuclear industry is doing heavy lobbying. But in the final analysis, I think it won't come to pass." Queried about his confidence on the matter, this self-professed Arabist admitted that he and his co-thinkers were counting on "the Israel lobby to take care of the whole matter."