EXCLUSIVE

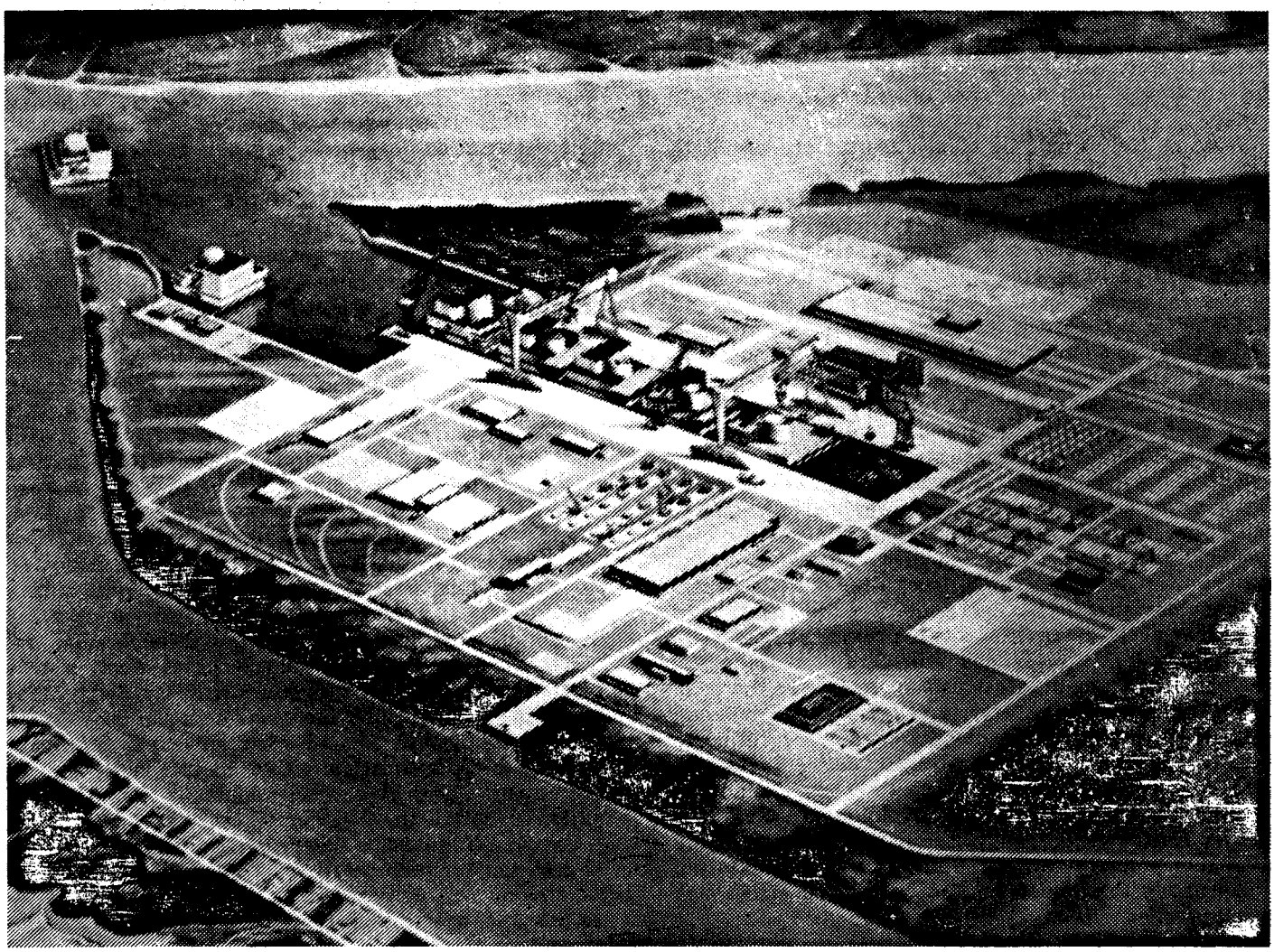
Assembly Line Production Of Floating Nuclear Plants

United States, French, and Soviet nuclear reactor industries are currently in the active stages of developing a little-publicized method of producing nuclear power plants in assembly-line "mass production." If fully applied to growing world energy needs, this can have a revolutionary impact on feasible approaches to massive programs of industrialization in developing countries and rapid expansion of industrial and energy capabilities in the advanced sector.

The technology is commonly referred to as the floating nuclear plant, or FNP, and as the name implies, it involves construction of nuclear power plants on barge-like structures which can be floated to the desired final location, either off an ocean coastline or in a river estuary sufficiently deep. The revolutionary aspect of the FNP concept is not the floating power plants per se, but that that fact allows a whole new approach to development of the power generating and related industry along the lines of employing modular mass-production techniques, computerized production processes and similar methods, long common to high technology industries such as aerospace.

The Concept

Present methods of constructing nuclear power facilities, commonly taking up to 5-6 years per plant, are based on a "case-by-case" individually designed construction siting made to fit widely varying terrain and



other site requirements. The enormity of each site (one 1,000 megawatt nuclear plant can provide enough electricity to power a city of 750,000) means that large nomadic teams of the most highly skilled craft and construction labor have to be recruited and assembled for each plant site for immensely complicated assembly of some of the most sophisticated engineering components having to be coordinated at each decentralized plant site.

With the FNP, all plants are built from a standard physical design and are centrally assembled at one facility much as shipbuilding is now done in advanced yards around the world. This allows the centralizing of all major subassembly at one site, assembly and floating the finished power plant to its ultimate mooring. Westinghouse Offshore Power Systems division, currently the only ones in the world actually constructing FNP's, estimates that once the production of several such plants has allowed development of maximum production process efficiency, it will be possible to construct a 1,000 MWe complete nuclear plant from the initial laying of keel to final delivery in 27 to 30 months! Such time scales are better by a factor of two or more over anything currently possible with decentralized on-site construction methods.

Although no presently existing shipyard facility in the world is sufficient to directly produce the 400 square foot barge-like structure needed for a 1,000 MWe reactor, the technology of any shipbuilding country is readily adaptable to construct a site with special large overhead gantry crane, and subassembly production factories surrounding it allowing production line assembly by crane.

Spain or Italy would be ideal sites for production of plants for destination anywhere contiguous to the Mediterranean region, including southern Europe, North Africa, the Mideast, Greece, and Turkey. Such plants should be part of integrated industrial complexes which would also be integrated into large desalination complexes for irrigation in such regions. Dredging and widening of the present Suez Canal, a project already under study to enable the larger super-tankers to carry oil and natural gas from the Persian Gulf to Europe, would enable economical delivery of FNP complexes from such Mediterranean sites to locations on the Red Sea and Persian Gulf, where future development perspectives see nuclear energy development as essential in order to develop infrastructure for industrialization of the entire Mideast region. Israeli technological cadre would be an essential component of such development, as well as an obvious site itself for such FNP power sources.

Scandinavian shipbuilding capacity readily lends itself to such an FNP construction site to provide plants for the countries on the North Sea and Baltic. In potential regional development locations such as the the Rio de la Plata region of South America, Argentine shipbuilding infrastructure would be an obvious choice for locating an FNP construction complex for that entire region, or possibly also Brazilian shipbuilding centers. Japan and South Korea could serve as the development location for the far East. In short, anywhere there exists the ready available industry infrastructure for substantial ship construction, there exists the capability to construct such a complex.

Current Westinghouse estimates are that an annual output of four, five at the most, is the optimum feasible production of any one FNP construction facility for reasons of scale and availability of highly skilled labor concentrations. While obviously not an absolute limit, this provides an estimate against which regional medium- and long-range power production needs can be measured.

From the standpoint of actual siting possibilities, floating nuclear plants offer a number of advantages, whose full potential has only partially been exploited. They can be sited in rivers, bays, estuaries, inshore, nearshore and even offshore locations as far as three miles out in the ocean. They require a depth of 45 to 65 feet of water and as little as 100 acres of geologically stable bottom. The offshore siting solves the requirements for access to large quantities of cooling water, often a major problem limiting on-land site possibilities. Since the offshore plant merely hooks up by cable in one manner or another with the on-land power grid, the development of present state-of-art light water fission reactor FNP construction complexes can readily be adapted to construction of floating fast breeder reactors as well ultimately as fission-fusion hybrid or fusion reactors.

In short, floating nuclear facilities offer an obviously desirable and vastly superior method of rapidly escalating world power production capability for vastly expanded industrial and agricultural output. The concept of the FNP has been in a serious developmental stage since the early 1970s when Westinghouse together with the Public Service Electric and Gas (PSE and G) utility of New Jersey began work on the idea. It is a testament to the stagnation of technological advance caused by a growing world economic and monetary decline that FNP's are not already rolling off the production lines in a number of countries.

The Westinghouse Case

For those who tend to be sensitive to the proliferation of Naderite scare stories of the supposed danger of conventional nuclear power plants, the idea of floating such a plant somewhere out in the ocean, or even near the shore, may bring up the question whether such floating structures would be comparable to a floating radioactive time bomb. What if a hurricane or even a huge supertanker should collide with the FNP? The best general answer to such question is the reminder that the first power application of nuclear energy more than twenty years ago was the nuclear powered submarine. Nuclear power plants are not bombs in any way shape or form; therefore the only valid question is: Given such a large single power source what is the potential for disruption of vital electric services through some unforseen catastrophe? The experience of Westinghouse Offshore Power Systems together with New Jersey PSE and G in preparation for the construction of the Atlantic Generating Station, located 2.8 miles out in the ocean, some 12 miles from Atlantic City, has provided some of the most exhaustive oceanological testing internationally to date to answer just these questions.

PSE and G, intending beforehand to ease the concerns of assorted environmentalists, decided to locate its first floating nuclear power plant as far from shore visibility as possible, providing a test of the applicability of the

FNP concept in by far the most difficult physical circumstances. Plants floated on the shore line or in less exposed water are far simpler to moor. In the Atlantic Generating Station, after exhaustive scale-model tests, a unique breakwater inside which the plant would float in permanent moorings was designed. The use of thousands of interlocking "dolosse," weighing anywhere from 11 to 62 tons, piled on top of a huge concrete and rock mound, created a uniquely porous yet firm structure able to withstand hurricane-force winds up to 204 mph and absorb the impact of a full-speed collision by a 326,000-ton supertanker with no damage inflicted to the plant. The station was sited in an area with no recorded seismographic evidence of earthquake disturbance, yet were such to occur, the plant would be unaffected since, being afloat, it is decoupled from the earth.

To answer questions about fish, a top level team of marine biologists under the direction of Dr. Edward C. Raney of Cornell University has set up a permanent research laboratory on the New Jersey shore to study the ecology of all species of marine life in the area of the plant. As a result, a screening system has been constructed around the underwater base of the plant which will insure that the 17 degrees warmer thermal discharge will be cooled to 4-5 degrees by the time any marine life comes into contact with it.

As a result of these slightly warmer but hardly destructive ambient temperatures, the breakwater surrounding the FNP will actually attract marine life, providing a sanctuary. Much to the dismay of various so-called friends of the earth, it was found that during the severe winter, when a nuclear power plant at Forked River, New Jersey had to be temporarily shut down, fish died from *lack* of the heated water emerging from the power plant. The Atlantic Generating Station would become a stupendous artificial fishing reef with the warmth of the thermal plume creating a form of magnet for lush algae, barnacles, sea bass, lobsters, and could potentially outdo the granites of Maine as tens of thousands of lobster would come to live in between the cracks of the concrete dolosse. A project director of the New Jersey Marine Ecological Study estimates that there would be more fish and shellfish in this area than in any other square mile in the Atlantic Ocean. The applicability of such centers for aquaculture research and development is an obvious area to be developed.

Construction of the dolos-covered breakwater itself is a major engineering feat. The Dravo Corporation of Pittsburgh has been awarded a contract for $200 million for a four-year construction job requiring building the 20-foot wide dolosse at a concrete yard on the Delaware Bay, ultimately producing some 18,000 of these dolosse using more than five million tons of material. It should be stressed that this first PSE and G plant is being constructed under the most stringent aesthetic and environmental constraints, which while it provides a useful affirmation of the range of applicability of the FNP concept, would not be necessary in areas where the ideology of "Naderism" has not polluted the local population, as the plants can be moored in breakwaters at the shore or in protected inlets, greatly reducing the cost and time of construction. The Atlantic Generating Station case is worth covering, however, if only to indicate the scale of engineering ingenuity and multiple benefits which could be the springboard to entire allied developments and multiple usage of such complexes.

In a sense it is ironic that the first impetus for the development of floating nuclear power stations grew out of "environmentalist" considerations. The real contribution of the concept is that it offers the possibility for assembly line mass production of nuclear power generating capacity in far shorter times than anything previously thought possible.

The fact that more countries have not begun crash development of this capability is largely due to the domestic delays in Europe, Japan and elsewhere caused in no small part by "environmentalist" sabotage of nuclear power through delayed court cased and heated demonstrations — added to the enormous problems of financing such large long-term capital expenditures in the face of a growing hyperinflationary international monetary crisis. A number of European governments in recent months have taken measures to come in and bail out their threatened domestic shipbuilding capacity through state takeover of the bankrupt but otherwise sound industries. This, combined with other state financing and credit guarantees tied to the growing number of nuclear technology transfer agreements between Europe and various OPEC and East Bloc countries, would be the obvious direction to go in order to provide credit for a crash development program. There is no need for the world to wait with baited breath until the first plant is floated out to the Atlantic Generating Station in 1984 by Westinghouse.

—William Engdahl