11-1-1981

Volume 5, Number 11 (November 1981)

The Solar Ocean Energy Liaison

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TECHNICAL DATA ARRIVES ON JAPANESE/NAURU OTEC PLANT

Information on the initial operation of the Japanese-built OTEC demonstration plant on Nauru has arrived piecemeal. OE mailed a special notice to all subscribers on October 15th, the same day we were notified by the builders, that the plant had begun operation the previous day.

Additional pertinent details appeared in our September issue, with photographs and technical data arriving just in time for this issue for a combined complete report. [See articles titled “Directory of Information on Nauru Plant” and “A Special Note of Thanks” in this issue.]

Since the announcement in mid-October, OE’s offices have been flooded with calls requesting technical specifics of the Nauru plant’s operation, which are now available and presented below.

The gross power output is 180 kilowatts, with a net power output of 103 kilowatts.

The power plant is operated for three hours daily, with the net power integrated into the Nauru power grid. When the Japanese builder/operators were asked why the plant was operated only three hours a day, they said that its purpose “is for demonstration only”.

Why the plant is not operated around the clock, as was Mini-OTEC, is unclear. However an American engineer suggested that, as with Mini-OTEC’s initial operations, consistent performance may not be possible due to the necessity of “getting the bugs out” of a new system.

Biofouling control is handled by sponge balls from Germany, most likely manufactured by MAN.

The temperature of the warm water varies between 27° and 30° Centigrade, (continued on Page 2)
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and that of the cold water varies between 50° and 70° Centigrade. Thus the delta-T ranges from 20° to 25° Centigrade.

[Editor's note: Nauru is in the area with the world's highest delta-T, based on the DOE/Ocean Data Systems world map, as published in our May 1978 issue.]

The Japanese have built a crossover system so that they can mix—and thereby adjust—the temperatures of the cold-water and warm-water intakes as the pipes come onto the beach.

The warm-water side's evaporator uses a shell-and-tube design of 400 tubes of copper-coated stainless steel, each an inch in diameter.

The cold-water side's condenser is of single fluted exterior titanium tubes, also one inch in diameter.

Freon-22 (called FLON- or FRON-22 by the Japanese) is the working medium.

The entire plant took four months to build. Aided by a subsidy of unknown amount from the Japanese Government, the total cost is estimated at $4 million. The Tokyo Electric Power Services Company (TEPSCO) has a contract with the Republic of Nauru to operate the demonstration plant for one year. Observers believe that total construction costs were borne by the Japanese, with Nauru donating the site. TEPSCO contracted the power unit to the Toshiba Corporation, and most of the construction was done by the Shimizu Construction Company Ltd.

Although this is unconfirmed, it is expected that if test results are adequate, Nauru will contract with the Japanese to build a 1.2-megawatt plant on the island.

DIRECTORY OF INFORMATION ON NAURU OTEC PLANT

Background information on the Japanese/Nauru OTEC demonstration plant can be found as follows:

OE's October 1981 issue: press release of October 14th, 1981; aerial view of plant; specifics and technical data on cold-water pipe; TEPSCO's rationale for using Freon-22 as the working medium; current velocity, temperature distribution, and land section of sea bottom at Nauru site; background on the Republic of Nauru; OTEC in Japan: The Government Program; OTEC in Japan: The Private-Sector Program.


OE's May 1981 issue: a detailed review of the Japanese OTEC program, including illustrations of a two-megawatt floating plant, a ten-megawatt Nauru plant, and a five-megawatt Yap Island on-shore plant; Japan's position in offshore construction internationally.


LAVI'S AUTHOR ARTICLE

OE has just learned (via the fall issue of The Wilson Quarterly) that an article entitled "The Shining Seas", describing OTEC technology and its worldwide potential, appeared in the April issue of The Sciences, a publication of the New York Academy of Sciences. The authors are Abraham Lavi and Gay Heit Lavi, both researchers at Energy Research and Development Incorporated of Pittsburgh.

Jay Lather (left), Director of the Guam Energy Office, chats with Hammar DeRoburt, President of the Republic of Nauru, at the opening ceremony on October 14th, 1981.

Solar OCEAN ENERGY Liaison Chicago 60605 November 1981
COMPARING THE JAPANESE NAURU OTEC DEMONSTRATION PLANT WITH MINI-OTEC

Inevitably, comparisons are being made between the 100-kilowatt (net output) OTEC demonstration plant just put into operation by the Japanese in Nauru, and the 50-kilowatt (gross output) Mini-OTEC demonstration plant in Hawaii in August 1979. OE will facilitate this natural comparison from a technical point of view:

The ratio of gross to net power for Mini-OTEC is 34% (53.0 kilowatts gross, 18.2 net), while the ratio for Nauru is 57% (180 kilowatts gross, 103 net). This is due largely, if not entirely, to the fact that the Japanese/Nauru plant was built to design, using optimized components, while Mini-OTEC used available off-the-shelf components. In addition, the delta-T is greater in Nauru (20° to 25° Centigrade) than in Hawaii (19° to 22° Centigrade).

Mini-OTEC used chlorine to control biofouling, while the Nauru plant uses mechanical control: sponge balls.

Mini-OTEC's cold-water pipe is 2,170 feet long and 24 inches in diameter, while Nauru's pipe is 2,896 feet long and 27.6 inches in diameter. Both are polyethylene.

Mini-OTEC used ammonia as the working medium, while Nauru uses Freon-22.

Cost comparisons are difficult if not impossible. While TEPSCO announced a partial subsidy from the Japanese Government in their press release for the Nauru plant, the form and extent of this subsidy are not known.

Mini-OTEC received no federal funding, yet the barge on which it was mounted was loaned by the US Navy and the heat exchangers were loaned by Alfa-Laval. Many services were provided by both the State and County of Hawaii either at low cost or gratis, as were some of the other components and services by private industry.

A SPECIAL NOTE OF THANKS

OE and the entire OTEC/ocean energy community are indebted to Mr. Jay Lather, Director of the Guam Energy Office, for both the photographs and the technical data in this issue. While this information has been requested by OE of the Japanese builder/operators of the Nauru OTEC demonstration plant, we were fortunate that Lather was present at the opening ceremonies in Nauru in October. His cooperation in providing this information by overseas telephone and during his recent US visit is greatly appreciated.

[Note: Two separate photographs were joined by OE to provide the overall view shown below of the Nauru installation, resulting in the appearance of nonalignment of pipes.] The pipe at the far right, on which Nakamoto and Lather are walking at low tide, is the 1-meter-diameter discharge (mixed effluent) outlet. The central pipe is cold water, with the warm-water pipe at the far left. Note the visible air hose (compressed air) used for cleaning the warm-water intake screen. Condenser structure and control house are shown on shore, far right. (Unrelated phosphate loading gantries are visible in the left background.)
TWO INDEPENDENT STUDIES BY FINANCIAL ORGANIZATIONS BODE WELL FOR RENEWABLE ENERGY

Although advocates of solar and other renewable energy are not jumping for joy these days as the Reagan Administration continues to reduce R&D spending and attack energy credits (see story in this issue), two investment firms point to a rosy future nonetheless.

Hambrecht & Quist, investment bankers in San Francisco, recently completed a study of the alternative-energy industry, saying it "should be one of the fastest-growing industries of the 1980's". The study predicts sales of more than $60 billion per year into the 1990's. (At present sales are just over $10 billion in the US alone.)

The report stresses the growth of conservation, small wind machines, and solar water heating in the early 1980's; industrial process heat for power generation, large wind machines, and biofuels in the mid-1980's; and central power generation, including OTEC, in the last decade of this century.

A second study, by Merrill Lynch Pierce Fenner & Smith Incorporated, entitled "Outlook for Alternative Generation Fi-
(continued on Page 5)
Yasunoba Nakamoto (left), Chief Project Engineer for Toshiba, talks with Jay Lather in the control house. They stand in front of the FLON turbine (3000 rpm).

(continued from Page 4)

Financial Techniques in Public Power”, sees utilities that use an increasing mix of alternative energy sources with conventional sources as good investments.

Their report concludes: “We believe that investors and consumers alike will be well served by progressive utility managers which blend alternative technologies and conservation measures into their power-generation program, and which utilize those innovative financing techniques which result in making the best of a difficult market environment.”

They recommend that investors try to “find utilities that are open-minded in evaluating conservation and alternative technologies”.

PUBLICATIONS AVAILABLE

The following publications are available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161:

Physical Properties of a Lightweight Concrete for OTEC Cold-Water Pipes, Special Reports, by J. S. O'Connor, Johns Hopkins University, Laurel, Maryland, 90 pages, is available as JHU/APL-SR-80-5B for $9.50 paper copy and $3.50 microfiche.

Lightweight Concrete OTEC Cold-Water Pipe Tests, Phase II, Special Reports, by J.S. O’Connor, Johns Hopkins University, Laurel, Maryland, 115 pages, is available as JHU/APL-SR-80-2C for $11.00 paper copy and $3.50 microfiche.

Verification Test for Cold-Water-Pipe Analysis, Part A, Test Description, Results and Modern Comparisons, by Johns Hopkins University, Laurel, Maryland, 346 pages, is available as JHU/APL-SR-80-2A for $24.59 paper copy and $3.50 microfiche.

Verification Test for Cold-Water-Pipe Analysis, Part C, Directional Sea Spectra, by Johns Hopkins University, Laurel, Maryland, 115 pages, is available as JHU/APL-SR-80-2C for $11.00 paper copy and $3.50 microfiche.

OTEC Elastomer Cold-Water-Pipe Preliminary Design Study, Final Report, by R. D. Mehring of Goodyear Aerospace Corporation, Akron, Ohio, 77 pages, is available as DOE/NOAA/OTEC-27 for $8.00 paper copy and $3.50 microfiche.

OTEC Cold-Water-Pipe Design for Problems Caused by Vortex-Excited Oscilla-
Listed below are procurement invita­
tions and contract awards related to OTEC in particular and ocean resources in general culled from the Commerce Business Daily. This is not to be construed, however, as a complete list.

Oct 7: Continental Shelf Processes Af­


Oct 8: Development of New Techniques for Seawater Sampling on a Fine Space and Time Grid: Negotiations are being con­ducted with the Northeastern Research Foundation Incorporated, Bigelow Labora­tory for Ocean Sciences, McKown Point, West Boothbay Harbor, Maine 04575. Of­fice of Naval Research, 800 North Quincy Street, Arlington, Virginia 22217.