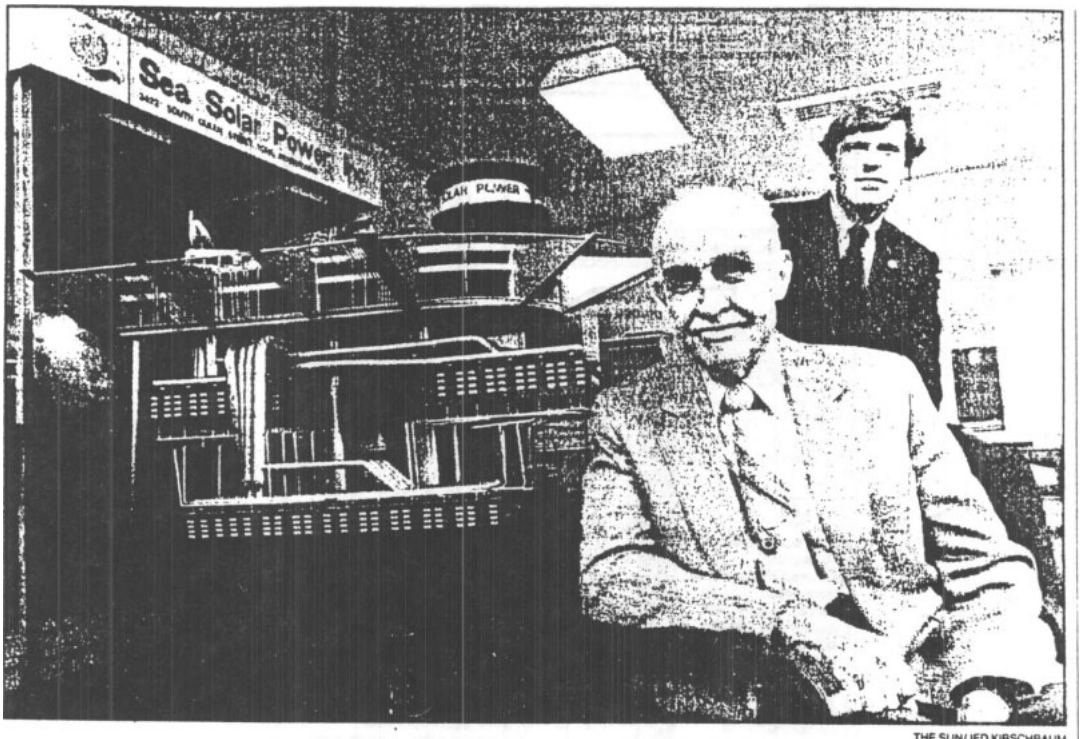

THE SUN/JED KIRSCHBAUM

J. Hilbert Anderson (left) and Robert J. Nicholson III of Sea Solar Power hope to use tropical seas as huge solar collectors.

A NEW KIND OF WATER POWER

By John H. Gormley Jr.
Sun Staff Correspondent

York, Pa.

J. Hilbert Anderson is a quiet, undemonstrauve engineer who has spent most of his 79 years unobtrusively designing arcane machinery such as turbines. compressors and heat exchangers.

His thinning hair and bushy eyebrows flecked wlth gray give him a grandfatherly aspect. the look of someone past trying to change the world. Nothing could be further fmm the truth.

This "little old man from York," as one of his associates calls him, believes he is on the verge of giving birth to a technology that will tap an almost inexhaustible supply of :heap. non-polluting power.

He hopes to see his company. Sea Solar Power. build a fleet of seagoing power plants that will use the tropical seas as huge solar collectors. The floatlng power plants would exploit the temperature difference between the warm surface water and the frigid waters at great depths to generate electricity.

The plants would generate more than lust power. Mr. Anderson claims. As a by-product. the floating power plants would produce large quantities of fresh water. And the nutrient-rich bottom water that would be pumped to the surface would support luxuriant fish life In what would otherwise be barren open ocean.

Mr. Anderson is basically a conservative, soft-spoken klnd of man. not the sort you would expect to brag. Yet thls is what he says about this technology: "Without question It will become the biggest source of energy in the whole world. It's inescapable.' and. 'It will have a' bigger impact of the economy of the world than anything In this century.'

For more than a quarter of a century he has k e n convinced of the practicality of thls technology — know as OTEC. for ocean thermal energy conversion. He quit the security of hls Job as chief engineer for the York Corp., then a division of Borg Warner. to pursue his Ideas. 1became convinced thls could be done In 1962 and quit my job In 1963 to pursue it' he said, "Year by year, we've solved the problems."

"Year by year, we've solved the problems" associated with ocean thermal energy conversion, a Pennsylvania engineer says.

The implications arc astonishing: a way for industrialized countries to reduce the pollutants believed responsible for acid rain and the greenhouse effect; and a source of food. fresh water and cheap energy In developing countries. And If the floatlng power plants were built at Bethlehem Steel's shipyard a' Sparrows Point (something Mr. Anderson says he would like to see happen). Maryland's manufacturing economy could experience a renaissance. Building thaw vessels. each costing hundreds of millions of dollars. could create thousands of jobs In shipbuilding, steelmaking and a host of other industries.

'Ive lived with It a long time," Mr. Anderson said. I know It's astonlshlng."

More than just astonlshlng to some. who dismiss it as too good to be true.

After all. researchers at the prestigious Johns Hopklns University Applied Physics Laboratory In Laurel worked on the concept of ocean thermal energy from the mid-'70s to the early '80s with the help of millions of dollars of federal funds. They came up wlth a plant design, but when energy prices collapsed In the mid-'80s, no one was willing to spend the money to build a prototype.

Dr. William H. Avery, director of ocean energy at APL. was In charge of the OTEC project them, He said the cost of a plant of the size that Mr. Anderson envlslons would have k e n about $500 mllllon. or about twice the projected cost of a Sea Solar plant.

Two years ago he went to York to hear Mr. Anderson explain the design and can away wlth doubts about the cost proje tlons. I belleve what he Is proposing w turn out to have great difficulties that w make the costs much hlgher than he sayr sald Dr. Avery. because the project requir "the development of new techniques ar procedures."

Dr. Avery. who describes Mr. Anderso as a "very capable man," does not flat claim that Mr. Anderson Is wmng. D Avery's essential point two years ago ar now Is that Mr. Anderson needs to do it development work to pmve the concept And Mr. Anderson conceded then, as t does now. that Dr. Avery Is right.

'We would never thlnk about building plant wlthout dolng the development ar testing work on the elements.' Mr. Ande son sald. "This Is common sense In eng neering."

From the relative obscurity of his offic In a former firehouse a few miles south downtown York. Mr. Anderson has labor for years to convince the skeptics.

Today some hard-headed business a engineering people are beginning to susp he Is right, paving the way for him to ra the funds to pmve his plant will work.

Within the next few weeks hls legal a financial advisers — respected names su as Venable Baetjer & Howard and Coop & Lybrand — will begin trying to raise fr private investors the $10 mllllon to $15 m lion Mr. Anderson will need.

That money will be used to design, bu and test prototype components: heat changers, turbines. generators and pum If that work confirms that hls engineerin sound. then the more than $250 mlll needed to build the first 100-megaw plant should be obtainable. Subsequt plants would cost about $140 mllllon $150 mllllon. Sea Solar officials said.

When Sea Solar Power tries to convir Investorsof the practlcallty of the plan. Anderson will have something he ne had going for him before: Independent c firmation from an Internationally pmr nent engineerlng firm that the technol appears to be sound and the econom

See POWER, 11D. Col

Anderson
79 in 88
84 in 93

88 150.0
89 165.0
90 181.5
91 199.65
92 219.615
93 241.57565
94 265.73415
95 292.307565
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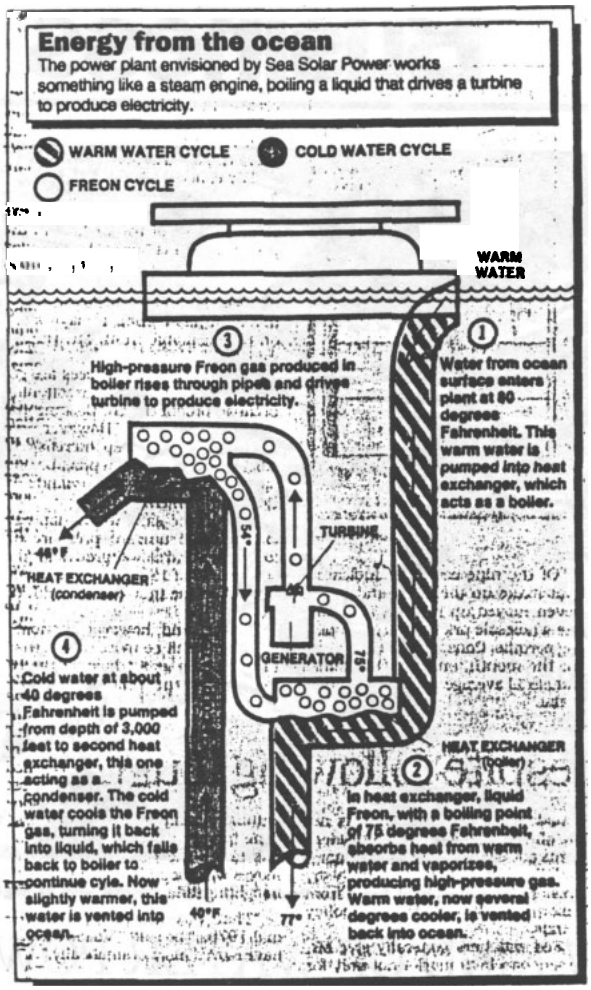

How vessels would work

The Sea Solar Power vessel conceived by J. Hilbert Anderson has no hull surrounding the heat exchangers, turbines and generators. Eliminating the hull makes the vessel much lighter and cheaper than other designs for ocean thermal power stations.

The absence of a hull also means that internal pressures of the plant's power system would be counterbalanced by the external pressure of the seawater surrounding the equipment, which also keeps the vessel light and holds down construction, costs.

The ship would be stationed in very deep water about 25 miles from shore and transmit power to shore through an underwater cable. The plant would not have to be moored, a very expensive proposition in water thousands of feet deep. Instead, it would use the jets of water emerging from the heat exchangers like batteries of thrusters. The direction of those flows could be controlled to keep the ship precisely in one spot.

The ability to hold position is crucial, since drifting would rip the ship loose from the cable carrying electricity to shore.

The actual power plant would run like an air conditioner or refrigerator in reverse. Instead of using electricity to produce a temperature difference, it would use a temperature difference to produce electricity.

Hot surface water boils Fmn. The pressurized Frwn vapor drives a turbine to produce electricity.

The *cold* water fromt the depths then condenses the Freon back to a liquid, which returns by gravity to the boiler.

Freon — a trade name for a variety of chlorofluorocarbons — is the suspected cause of depletion of the ozone layer in the upper atmosphere that filters out harmful ultraviolet radiation. As a result of those scientific concerns, there have been calls for banning the production and use of some Freons.

Mr. Anderson said that the Freon he plans to use, R-22, is the same type used in home refrigerators and is not very dangerous in comparison with R-12, the kind used in car air conditioners. If there was a leak of R-22 in his plants, the heavy liquid would sink harmlessly into the ocean, he said.

Even if all the Freons are banned, his plant could use other liquids, such as ammonia or propylene, without changing the economics of the plant significantly, according to a study by the Fluor Daniel engineering company.

— John Gormley

Potential of floating power plants said to be huge

POWER, from 1D

practical.

Fluor Daniel Inc., one of the largest engineering and construction companies in the world, with considerable experience with offshore structures such as oil rigs, conducted a preliminary study that indicates the Anderson design is technologically sound and holds great economic potential.

'We did make the case — there's no question the technology works.' said John Brewer, the study manager for Fluor Daniel.

While the study emphasized that the project involves considerable risks and that muchdevelopment work remains to be done to-prove the economics. it also said the plant should be able to produce a profit for its owners.

The study found:

- The first plant would cost about $273 million to build, a figure close to the 8250 million Sea Solar has been estimating.
- If built in the United States, the plant would generate a 12.2 percent rate of return, assuming electricity prices remain steady.
- Assuming rising prices for electricity and construction of the plant in South Korea, the rate of return would be 18.4 percent.
- The plant could sell power initially at 6% cents per kilowatt-hour. (That compares with the average price of 6.18 cents Baltimore Gas & Electric charged its customers last year.)

While the need for warm surface water year-round limits the operation of the plants to the tropics and places bordered by warm water currents. that range includes much of the developing world.

A price of 6% cents per kilowatt-hour is significantly less than the cost of power in many parts of the world. "Our studies show the unit is capable of generating power at a cost less than most commercial power sold today: Mr. Brewer said.

In island nations in the developing world, the prime market for these plants, electricity is often generated in oil-fired plants and typically costs about 15 cents a kilowatt-hour. Mr. Anderson said.

The consultants warned that theirs was a preliminary study, and that they were not guaranteeing investors that Sea Solar power could develop a practical and economically successful plant. Sea Solar Power will still have to perform detailed engineering work and then build and test models and prototypes of the essential elements of the plant And a full-scale plant, If built, would have to survive the difficulties of operating at sea amid changing economic conditions.

The biggest area of uncertainty involves the heat exchangers, which are at the heart of the design. The heat exchangers determine just how efficiently the plant can exploit the differences in temperature between the surface and bottom water. The more efficient they are. the lower the cost of the plants will be. And since the fuel cost is zero, the cost of building the plant will largely determine the cost of the electricity it produces.

'We don't have specific enough information on the thermal efficiencies of the heat exchanges to specify the quantity' of heat exchangers needed. said Mr. Brewer. His company will do the testing required to build the ship plant If Sea Solar Power can raise the development money.

William T. Osborne, the director of marketing for Baltimore Aircoil Co., which makes heat exchangers. said he is convinced the heat exchangers will perform as Mr. Anderson has predicted. About two year ago, Mr. Osborne's company had been considering joining a consortium to build floating power plants and studied the Anderson design.

"I was able to prove to myself that the power cycle part of this is completely viable.' he said. 'Anderson is not expecting efficiencies beyond what's been demonstrated by other people."

Mr. Brewer was more cautious, however. He said there are experts who would doubt the feasibility of building full-size heat exchangers' that would deliver the needed energy. "Things done in the laboratory don't necessarily scale up the way you would like than to," he said.

Bryson Cook. a partner in the Baltimore law firm of Venable Baetjer & Howard, said he is now putting together material on the project to present to potential investors. including major corporations and wealthy Individuals. who would be offered a stake in the company.

Mr. Cook originally got involved in the project as part of his efforts to help promote economic development in the state. And If the plant does turn out to be feasible. the economic implications would be "absolutely phenomenal.' he said. You could not overestimate the impact.'

Mr. Cook said Sea Solar Power already has an "expression of interest" from the government of Indonesia to buy the power from four plants. "They've agreed to buy power at a certain price," he said.

If Fluor Danlel confirms the economics of the plants and that expression of interest can be converted into a binding contract. then Sea Solar should be able to raise the $500 million to 5600 million needed to build the plants.

Once a few of the plants are operating successfully, the possibilities are enormous. 'It's somewhat like saying you've found a cure for cancer," said Mr. Cook.

He said the material for presentation to potential developers should be ready in several weeks. Raising the money will take six months to a year: doing the development work would take an additional year and a half to two years: the first plant could go into operation In five or six years.

"It will work. It's just a question of when and If Mr. Anderson will live to see it." Mr. Cook said.

James Zug, who Is with the accounting firm of Coopers & Lybrand in Baltimore, has also been assisting Sea Solar Power In getting the project going. He believes the Fluor Daniel report gives Mr. Anderson a good chance of raising the development money. While there Is some risk associated with the project, I don't think that risk is very high," he said. "I really do believe this is for real.'

12.2% x 273 Million = $33.306 Million / Year R.O.I

SSP IS A CONSORTIUM

4 PLANTS FOR INDONESIA ($500-600 M)
6 PLANTS FOR INDIA

BRYSON COOK WILL PRESENT TO INVESTORS IN A FEW WEEKS (AUG '88)

RAISING MONEY FOR PROTOTYPES = 6 MO.
THATS FEB '89

DOING THE DEVELOPMENT IS 2 YRS
THATS FEB '91

FIRST PLANT BEGINS OPS IN 6 YRS
THATS FEB '95

NOW ITS '93 LATE, STILL TALKING
NEEDING $12.5 MIL TO GET $250M
TO START CONST. IN '96 TO
OPERATE #1 IN '98.