

THE OCEAN THERMAL ENERGY CONVERSION ACT OF 1980

Recent technological breakthroughs have made ocean thermal energy conversion (OTEC) units a possible source of energy in the near future. OTEC units utilize temperature differences between ocean surface water and cooler deep water to produce energy. There is a need to state jurisdictional authority over these new activities¹ and to formulate government policies concerning regulation.² Congress has passed the Ocean Thermal Energy Conversion Act of 1980 (the Act)³ to facilitate commercial development of this method of using stored solar energy in ocean surface waters. This legislation establishes a simple one-step licensing procedure,⁴ states government policy concerning OTEC,⁵ and makes OTEC units eligible for financial assistance.⁶

The concept of using temperature differentials between surface and subsurface waters in tropical ocean areas as an energy source is not new, although the process has only recently become practical.⁷ Two basic design systems have been developed. The Closed Type systems use warm surface water to vaporize a working fluid such as freon or ammonia. The expansion of this fluid propels a turbine.⁸ Open Type systems use warm surface water as the primary fluid. This water, when placed in a partial vacuum, vaporizes and drives the blades of a turbine. In both systems, the colder subsurface water provides a means of lowering the

¹ 126 CONG. REC. H6187 (daily ed. July 21, 1980) (remarks of Rep. Studds). Although admiralty law generally governs most legal questions arising on the high seas, it does not speak to many of the aspects of OTEC activities, as they have not yet been undertaken. Since commercial application of OTEC is the ultimate goal, this barrier of uncertain jurisdiction should be surmounted. See generally, Nanda, *Ocean Thermal Energy Conversion Development under U.S. and International Laws and Institutions*, 8 DEN. J. INT'L L. & P. 239 (1979).

² *Id.*

³ Ocean Thermal Energy Conversion Act of 1980. Pub. L. No. 96-320, 94 Stat. 974 (1980) (to be codified in 42 U.S.C. § 9101) [hereinafter cited as the Act].

⁴ *Id.* § 102(f).

⁵ *Id.* § 2.

⁶ *Id.* § 201.

⁷ H.R. REP. NO. 994, 96th Cong., 2d Sess. 26 (1980). French physicist Arsene d'Arsonval realized in 1881, that a heat engine could be based upon thermal sea gradients. Unsuccessful experiments on this basis were conducted in the 1930s by Georges Claude at Motanzas Bay, Cuba. The August 7, 1913 issue of *Engineering News* contained an article by an American named Campbell, who proposed the same type of liquified gas method currently used in the Closed Type systems described below.

⁸ *Id.* at 24.

temperature of the primary working fluid so that it may be reused.⁹ Energy is derived from these two systems in several ways. The expansion of the working fluid in either system can be used to drive a turbine, which generates electricity. Underwater cables then transfer surplus electricity to shore.¹⁰ Alternatively, the power produced by the turbine could be used to make energy-intensive products such as ammonia,¹¹ which might yield energy in the form of fuel cells for the manufacture of electricity,¹² or as a synthetic fuel replacement for gasoline and alcohol.¹³ In addition, ammonia production could result in a significant savings in the United States supply of natural gas. At present, approximately four percent of United States domestic natural gas is required for the production of ammonia needed for agricultural fertilizers and other commercial uses.¹⁴ OTEC production of ammonia would free agriculture from its dependence on potentially unstable sources of foreign ammonia.¹⁵

Small scale research and development designed to investigate the potential of OTEC has been underway in the private sector for several years.¹⁶ However, Congress did not recognize the urgent need to develop alternative sources of energy until the 1973 Arab oil embargo. The Solar Energy Development Act of 1974¹⁷ reflected the growing recognition that energy imbalances are not short-range phenomena.¹⁸ Members of Congress believed that an

⁹ *Id.*

¹⁰ *Hearings on Ocean Thermal Energy Conversion Oversight Before the Subcomm. on Oceanography of the House Comm. on Merchant Marine and Fisheries, 96th Cong., 1st Sess. 2 (1979)* [hereinafter cited as *Hearings on Ocean Thermal Energy Conversion Oversight*] (Statement of Evans Francis). Although entry of OTEC into the mainland energy market is unlikely until commercial use has shown viability, use of OTEC in tropical areas of the United States should be possible almost immediately. Areas such as Puerto Rico, the U.S. Virgin Islands, Guam, and Hawaii may be able to use OTEC in the late 1980s. They have better thermal sea gradients than other portions of the nation and are almost totally dependent on oil for electricity generation.

¹¹ *Id.*

¹² H.R. REP. NO. 994, *supra* note 7, at 33. The large amounts of hydrogen in ammonia could be converted to chemical energy in fuel cells. This stored energy can then be used to produce electricity. Factories and communities which cannot tolerate coal or nuclear powered electrical generating systems would therefore benefit even though far removed from the sight of OTEC units.

¹³ *Hearings on S. 2492 Before the Sen. Comm. on Commerce, Science, and Transportation, 96th Cong., 2d Sess. 71 (1980)* [hereinafter cited as *Hearings on S. 2492*] (Statement of John Carver).

¹⁴ *Hearings on Ocean Thermal Energy Conversion Oversight, supra* note 10, at 4.

¹⁵ H.R. REP. NO. 994, *supra* note 7, at 30.

¹⁶ *Id.* at 28.

¹⁷ 42 U.S.C. §§ 5551-5566 (1976 & Supp. III 1979).

¹⁸ *Id.* § 5551(a)(2).

increased national effort in several specific areas of solar energy research, including thermal sea gradients,¹⁹ would reduce dependency and strengthen national security.²⁰ Federal government responsibility for OTEC research originally was delegated to the National Science Foundation's Research Applied to National Needs Program.²¹ In 1974, OTEC development was transferred to the Energy Research and Development Administration,²² and it currently falls under the jurisdiction of the Department of Energy.²³

Recent developments in OTEC research reveal great promise. In 1978, the applied physics laboratory of Johns Hopkins University completed a design for a forty megawatt plant, which could be constructed by conventional means.²⁴ Additionally, the State of Hawaii, along with private industry and the United States Navy, combined to build a small test plant, which began operation in 1979.²⁵ This "Mini-OTEC" unit produced net power by a Closed Type OTEC system located off Keahole Point, Hawaii.²⁶ OTEC-1, the main federal-level test unit, became operational in June of 1980.²⁷ The main purpose of OTEC-1 is the testing of heat exchangers and other hardware necessary for a commercial-level OTEC unit.²⁸

The Ocean Thermal Energy Act was designed to deal with the authorization, regulation, construction, location, ownership, and operation of OTEC facilities and plantships.²⁹ The Act originated in late 1979 after hearings by the House Subcommittee on Oceanography.³⁰ Both the Senate and House versions of the bill

¹⁹ *Id.* § 5555(c)(2).

²⁰ *Id.* § 5551(a)(7).

²¹ H.R. REP. NO. 994, *supra* note 7, at 27.

²² Energy Reorganization Act of 1974, 42 U.S.C. §§ 5801-5891 (1976 & Supp. III 1979).

²³ 42 U.S.C. § 7151 (Supp. III 1979).

²⁴ *Hearings on Ocean Thermal Energy Conversion Oversight, supra* note 10, at 5.

²⁵ H.R. REP. NO. 994, *supra* note 7, at 13.

²⁶ S. REP. NO. 721, 96th Cong., 2d Sess. 3, *reprinted in* [1980] U.S. CODE CONG. & AD. NEWS 4432. "Mini-OTEC" was in operation for about two months. For two weeks it operated continuously, producing fifty to fifty-five kilowatts of gross electrical power. The facility required about forty kilowatts to run its pumps and auxiliary functions, leaving a ten to fifteen kilowatt surplus of electrical power. Many experts believe this to be proof of the OTEC principle. H.R. REP. NO. 994, *supra* note 7, at 30.

²⁷ *Id.*

²⁸ *Id.* at 30. OTEC-1 is a converted Navy type T-2 tanker. It is expected to yield data on heat exchangers, cold water pipes and other hardware by 1981.

²⁹ Act, *supra* note 3, § 2. The Act distinguishes "facilities" and "plantships" by describing facilities as structures which are moored to the ocean floor whereas plantships are not. *Id.* § 3.

³⁰ 126 CONG. REC. H6187 (daily ed. July 21, 1980) (remarks of Rep. Studts).

were designed to surmount the final barriers to commercial application of OTEC.³¹ The Senate passed its version on July 2, 1980.³² The House of Representatives approved a virtually identical version on July 21, but vacated passage in lieu of the Senate form.³³ President Carter signed the bill into law on August 4, 1980.³⁴

One manner in which the commercialization of OTEC can be promoted is by simplifying licensing procedures. Title I of the Act attempts this simplification by establishing a licensing and permitting framework within the National Oceanic and Atmospheric Administration (NOAA). The Act provides that a single application for a license filed with NOAA will be considered as the application for all federal authorizations that may be necessary to begin operation, ownership, or construction of an OTEC unit.³⁵ NOAA is responsible for forwarding copies of each application to federal agencies and departments with jurisdiction over any aspect of the proposed unit.³⁶

In addition to consolidating the application process, the Act provides for a relatively short period for government action on an application for a license. The application must be published by NOAA within twenty-six days of its receipt.³⁷ The Act requires public hearings on each proposed unit, which must be concluded within 240 days after the initial publication of the application.³⁸ Any other federal agencies to which NOAA has forwarded an application must reach a decision no later than forty-five days after the hearings.³⁹ NOAA has ninety days after the end of the public hearings to make a final decision on the application.⁴⁰ As a result

³¹ *Id.* and *Hearings on S. 2492*, *supra* note 13, at 1 (statement of Sen. Inouye).

³² 126 CONG. REC. S9262 (daily ed. July 2, 1980).

³³ 126 CONG. REC. H6200 (daily ed. July 21, 1980).

³⁴ 16 WEEKLY COMP. OF PRES. DOC. 1473 (Aug. 4, 1980).

³⁵ Act, *supra* note 3, § 102(f). The application made to NOAA does not cover continuous regulatory activities of the Coast Guard such as documentation, inspection, certification construction and manning requirements.

³⁶ *Id.* The agencies or departments that receive a copy of the application from NOAA may comment, recommend, or review based on legal responsibilities within their area of jurisdiction.

³⁷ *Id.* § 102(d)(1). Within 21 days of receipt, the NOAA must decide if the application contains the financial, technical, and other information required by § 101. The license application must be published no more than five days after the decision.

³⁸ *Id.* § 102(g). At least one public hearing must be held in the District of Columbia. If the proposed unit will be connected to a state by cable or pipeline at least one public hearing must be held in that state.

³⁹ *Id.* § 102(f).

⁴⁰ *Id.* § 102(i)(1). In making the determination, the Act requires the NOAA administrator to decide if the proposed OTEC unit clearly serves the national interest. The administrator,

of this timetable, proposed OTEC units should be licensed no later than one year after the original application is submitted.

Although the Act's application process clears many hurdles to commercialization of OTEC, it does not do so at the expense of environmental, safety, and other concerns. The Act requires environmental impact statements for each proposed OTEC unit,⁴¹ and instructs NOAA to set up a program designed to assess the cumulative environmental impact of a large number of OTEC units.⁴² Furthermore, each license must include conditions that the OTEC unit be constructed and operated with reasonable regard for navigation, fishing, energy and mineral production, scientific research, and other uses of the high seas by the United States and other countries.⁴³

In addition to addressing licensing and environmental concerns, the Act attempts to clear some of the financial barriers to commercial use of OTEC by defining all OTEC facilities, plantships, and the vessels servicing them as "vessels operated in the foreign commerce of the United States."⁴⁴ The effect of this definition is to allow OTEC units and service ships to use the capital construction funding provisions of the Merchant Marine Act of 1936.⁴⁵ OTEC

in consultation with the Secretary of Energy, is guided by several factors. In determining whether one or a specific combination of units is desirable, consideration should be given to the goal of making the greatest use of OTEC capabilities by installing the largest number of units practicable in each application area. The net energy that proposed units will produce should be balanced with environmental effects. Ultimate consumer costs should be kept in mind when deciding on several proposed units for a single area. Significant differences in start up times must be weighed with construction and operating costs. *Id.* § 102(i)(3).

⁴¹ *Id.* § 107(e). The National Environmental Policy Act of 1969, 42 U.S.C. § 4321 (1976), requires an impact statement for "major federal actions." 42 U.S.C. § 4332(2)(c). OTEC units are deemed to come under this heading. Recognizing that one of the ways to accelerate commercial use of OTEC is through a reduction of regulatory schemes, the Act provides for a single environmental impact statement when several units are proposed for a single area. Only one statement is required if the application is for a plantship. Act, *supra* note 3 § 107(e). By reducing the duplication of statements, another barrier to commercialization is cleared while keeping environmental policies in force.

⁴² *Id.* § 107(a). Through initial studies, research and monitoring of OTEC operations, this program should ultimately indicate whether a ceiling on the number of OTEC units is desirable. The problems associated with the operation of transmission cables and equipment are to be explored. Specific mention is made of the possible environmental hazards of accidentally severed transmission cables.

⁴³ *Id.* § 109(a).

⁴⁴ *Id.* § 201(a)(1).

⁴⁵ The Merchant Marine Act of 1936, 46 U.S.C. §§ 1101-1294 (1976 & Supp. III 1979), provides for federal assistance in shipbuilding and repair. 46 U.S.C. § 1177. One form of this assistance is the capital construction fund, which reduces the taxation of money used for ship construction. It also provides for a reduction in the tax basis for the vessel when construction is finished.

units and their service ships are also eligible for federal mortgage guarantees of up to 87.5% of their cost.⁴⁶

Perhaps the most problematic aspect of the Act is that dealing with jurisdiction. The Act extends its regulatory scheme over four types of OTEC units: those within the territory of the United States,⁴⁷ those documented under the laws of the United States,⁴⁸ those operated or owned by United States citizens,⁴⁹ and those connected to the United States by cable or pipeline.⁵⁰ Questions concerning the legal basis for jurisdiction arise in relation to the three-mile limit on the territorial sea currently recognized by the United States.⁵¹ Because some units are likely to be outside the territory of the United States, another manner of asserting jurisdiction over them is necessary. However, the Act declares that it will not affect the legal status of the high seas, the superjacent airspace, or the continental shelf.⁵² The Act also is consistent with the general principles of international law and the Convention on the High Seas.⁵³ The proposed Law of the Sea Treaty specifically allows a nation to exercise jurisdiction over thermal energy conversion units up to 200 miles from the coast of that nation.⁵⁴ Because this treaty has not been given final approval, it is not yet a proper basis for jurisdiction.

In terms of accepted international custom, the power to regulate units can be based on either citizenship⁵⁵ or documentation

⁴⁶ Act, *supra* note 3, § 202(c). This portion of the Act ties OTEC units into the Federal Mortgage Insurance plan, 46 U.S.C. § 1271 (1976), wherein the federal government guarantees the mortgages entered into for the purpose of financing OTEC construction. Since ocean thermal energy conversion has not yet demonstrated commercial practicability, lending institutions might be hesitant to provide the massive financing required if such guarantees were not available.

⁴⁷ Act, *supra* note 3, § 2(a)(1).

⁴⁸ *Id.* § 2(a)(2).

⁴⁹ *Id.* § 2(a)(3).

⁵⁰ *Id.* § 2(a)(1).

⁵¹ RESTATEMENT (SECOND) OF FOREIGN RELATIONS LAW OF THE UNITED STATES § 15. Within its territorial boundaries, a nation's jurisdiction is absolute. Therefore, regulating OTEC units outside the territorial seas of the United States is the real problem.

⁵² Act, *supra* note 3, § 121(b).

⁵³ *Id.* § 109(a).

⁵⁴ United Nations Draft Convention on the Law of the Sea, Informal Composite Negotiating Text (Rev. 1) art. 56. The Proposed Treaty is the culmination of the United Nations Conference on the Law of the Sea. The Act contemplates the passage of the treaty into law by instructing NOAA to bring all regulations into congruence with the treaty if it is ratified by the United States. Act, *supra* note 3, § 161.

⁵⁵ RESTATEMENT (SECOND) OF FOREIGN RELATIONS LAW OF THE UNITED STATES § 30. It is well accepted that a nation has jurisdiction to prescribe rules of law attaching legal consequence to the conduct of its citizens wherever that conduct occurs.

under national law.⁵⁶ The original House version of the Act asserted jurisdiction based on the Convention on the Continental Shelf.⁵⁷ This convention gives coastal states sovereign rights over the continental shelf and subsoil for purposes of exploration and exploitation of natural resources.⁵⁸ However, the Convention specifically states that it does not affect the status of the waters above the continental shelf.⁵⁹ In view of the fact that it fails to mention exploitation of resources in these waters, the Convention is an inadequate basis for jurisdiction.⁶⁰

The final version of the Act eliminated the continental shelf basis of jurisdiction. Under the final version, jurisdiction may be asserted over any cables and pipeline grounded in the United States. This method, included because of State Department insistence,⁶¹ has a tenuous legal basis. For many years, the United States has claimed jurisdiction over the grounding of cables coming from foreign territory.⁶² It may be asserted that claiming jurisdiction over the landing of a cable is quite different from asserting power to regulate any unit connected to that cable. However, this minor extension of United States jurisdiction may be unimportant for two reasons. First, the Law of the Sea Treaty grants the power to regulate OTEC units.⁶³ Second, it is unlikely that an OTEC unit owned by foreign nationals and documented

⁵⁶ Convention on the High Seas, done April 29, 1958, 13 U.S.T. 2312, T.I.A.S. No. 5200 (effective March 24, 1961). Ships sailing under the flag of a nation shall be subject to the exclusive jurisdiction of that nation while on the high seas. *Id.* at art. 6. Since OTEC units are designated as "vessels" in other parts of the Act, this would seem an adequate manner of basing jurisdiction over them.

⁵⁷ H.R. 6154, 96th Cong., 1st Sess., § 2(a)(1) (1979).

⁵⁸ Convention on the Continental Shelf, done April 29, 1958, 15 U.S.T. 471, T.I.A.S. No. 5578 (effective June 10, 1964). art. 2, § 1.

⁵⁹ *Id.* Art. 3.

⁶⁰ *Hearing on H.R. 6154 Before the House Subcomm. on Oceanography of the House Comm. on Merchant Marine and Fisheries*, 96th Cong., 2d Sess. 444 (1980) (Statement of Morris Busby).

⁶¹ Telephone interview with Rich Nordling, Staff Counsel for the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries (Oct. 22, 1980).

⁶² 42 U.S.C. § 34 (1970) is a portion of the Cable Act. It states that no one may land a cable directly or indirectly connecting the United States with any foreign territory without obtaining a license. It is difficult to see how power over the grounding of cable connected to "foreign territory" such as the high seas can give jurisdiction over units connected to such cables.

⁶³ The proposed Law of the Sea Treaty encompasses a new concept called the exclusive economic zone. A coastal state would have sovereign rights regarding exploitation and exploration as far as 200 miles from its coast. Art. 56, ¶ A, specifically mentions activities such as production of energy from the water, current, or winds. Paragraph B gives the coastal state jurisdiction over the establishment and use of artificial islands, installations, and structures.

under the flag of another country would locate off the coast of the United States.

The Ocean Thermal Energy Conversion Act is a valid attempt to provide a federal response to the nascent OTEC industry. The Act is progressive in that it regulates without burdensome bureaucratic duplication. Furthermore, the United States increasing need for alternate energy sources is balanced admirably with the contemporary desire to avoid massive federal spending on new projects. The Act should play a major role in the growth of this promising form of energy production.

Paul Kish

