



Offshore Infrastructure Associates, Inc.

Ocean Thermal Energy Conversion
(OTEC)
For the Tropics

Presented to WIREC:
March 4, 2008

The Process for converting Ocean Thermal Energy to Electricity is very similar to the conversion of Geothermal Energy to Electricity except the temperature difference is less, just over 20 degrees Celsius rather than a temperature difference of 80 degrees Celsius or more



An Energy Solution

Video Downloadable from: http://www.offinf.com/otec_movie.htm

Off the Big Island of Hawaii

MiniOTEC
(1979)
50 kW CC-OTEC

Designed and Built by Lockheed

Nauru (1982)

100 kW CC-OTEC



Designed and built by Toshiba Corporation

210 kW OC-OTEC Experimental Plant



Project Manager Dr. Luis Vega with PICHTR

(1993-1998)

Hawaii, Big Island




**Desalinated
Water
Production
(1994-1998)**

Whatever Happened to OTEC?

- High Capital Cost
- High Interest Rates
- Lots of Oil
- Low prices for Fossil Fuels and inaccurate future projections of Oil prices.
- Lack of accurate knowledge about the current status of OTEC development. All technical issues have been solved.
- Lack of funding

11/26/79
11106
EE-11 WIND ENERGY PROGRAM - 410 267 7247
RU 690



The Secretary of Energy
Washington, DC 20585

January 13, 1995

The Honorable Al Gore
President of the Senate
Washington, DC 20510

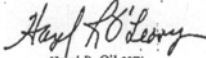
Dear Mr. President:

The Department of Energy is submitting this letter report in response to sections 3 and 6 of the Ocean Thermal Energy Conversion Research, Development, and Demonstration Act, 42 U.S.C. §§9002 and 9005. These provisions require annual updating of the comprehensive program management plan and the comprehensive technology application and market development plan for the ocean thermal energy conversion technology development program.

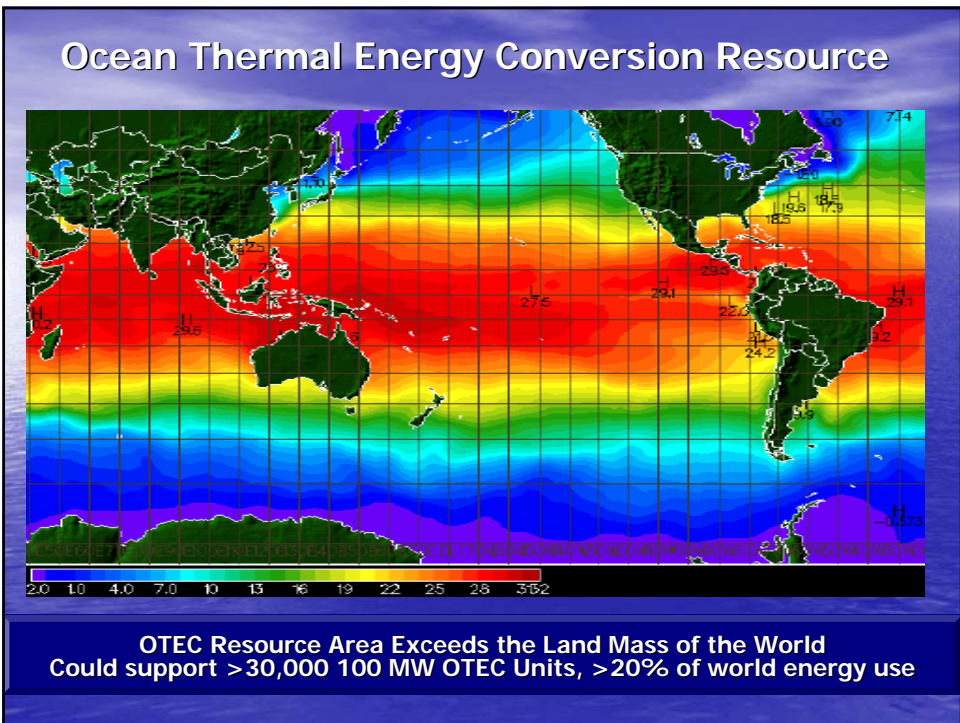
In prior years, the Department of Energy reported that a technical data base, sufficient to assist industry in judging where and when this technology could be commercialized, had been developed based on testing small-scale ocean thermal energy conversion systems. However, this technology has yet to be used in a commercial-scale power plant by industry. Unlike their approach for other renewable technologies, industry leaders have not shown a willingness to make a substantial financial commitment to ocean thermal energy conversion, and industry has not formed the supporting infrastructure necessary for commercial development.

In view of the above, the Administration did not propose funding for ocean thermal energy conversion activities in the fiscal year 1995 budget request, nor did the Congress provide funding in the fiscal year 1995 appropriations. The Department of Energy has no activities for this technology for fiscal year 1995 and has closed out the program. Accordingly, the Department of Energy does not plan on further yearly updates to the above plans.

Sincerely,


 Hazel R. O'Leary

Low oil prices caused the abandoning and discarding of the multi hundred million dollar data base without conversion to electronic media.



Each 100 MW OTEC Plant

Provides Base Load Electricity for 100,000 people

- Produces 800 Million kWh of electricity per year
- Saves 1.3 million barrels of oil each year
- Produces no Carbon Dioxide (avoiding the generation of up to 800 thousand tons of CO₂)
- Can be designed to co-produce 120 million liters of fresh water per day
- Moves four cubic KM of high nutrient deep water per year (1 square Kilometer 11.5 Meters deep each day, enough to grow 70 Tons of shellfish meat per day) costing ~\$200 million per year at the current pumping cost for NELHA in Hawaii.

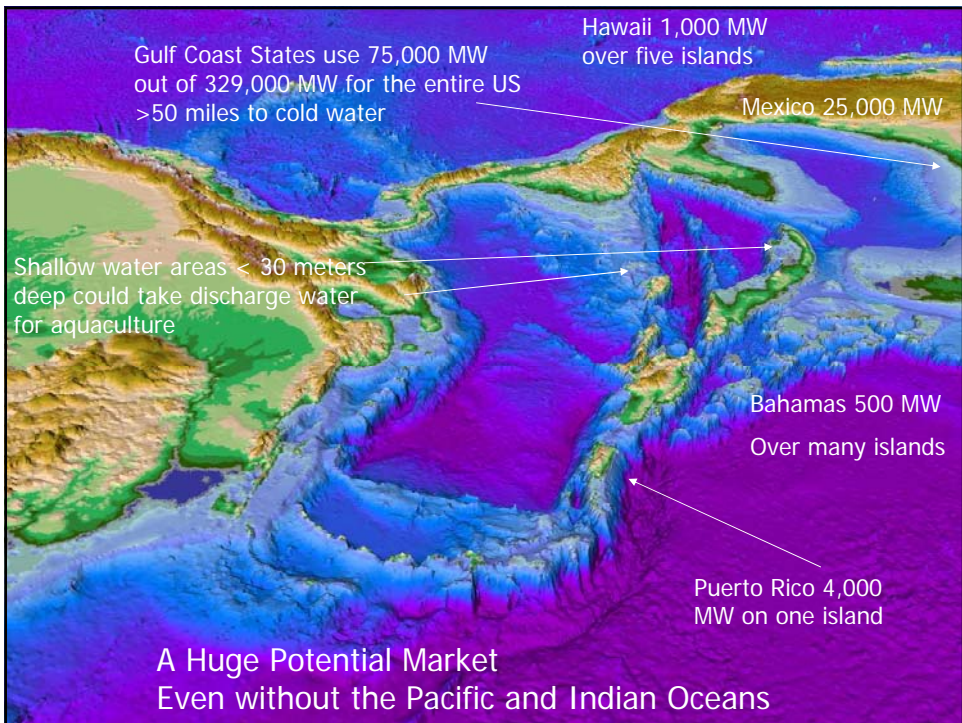
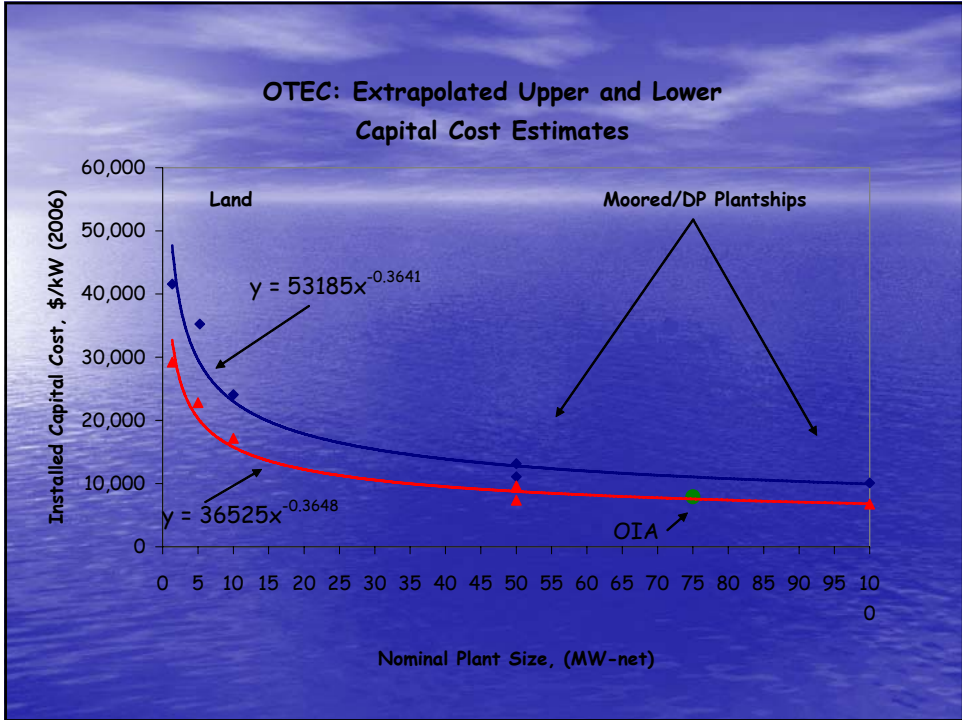
An Interim Possibility

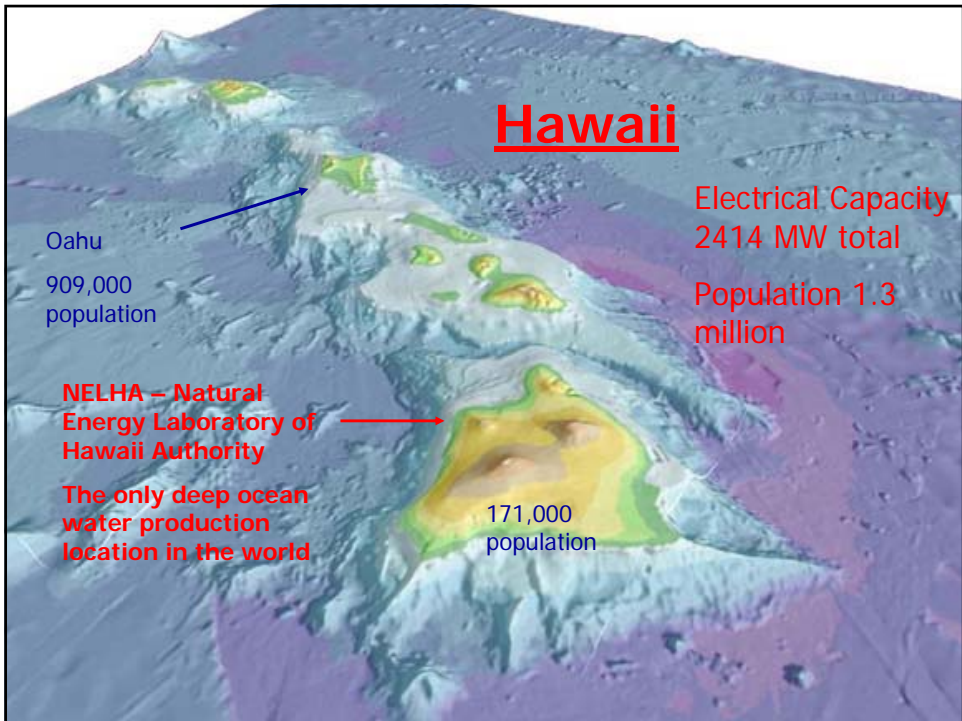
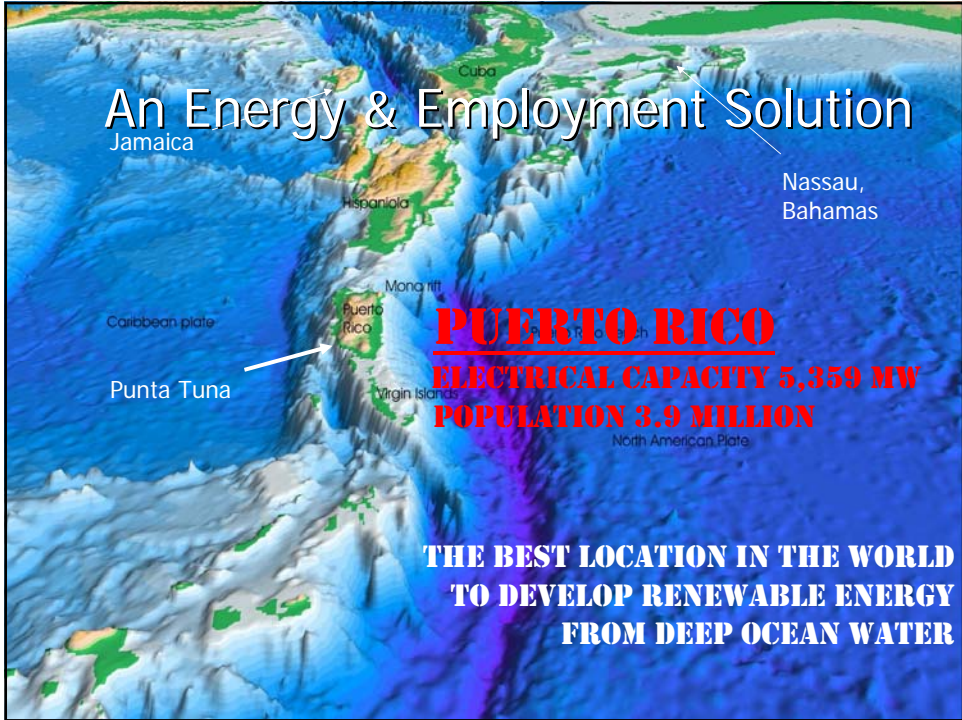
An OTEC Pilot Plant with commercially available & proven components

A 2MW land based unit would provide:

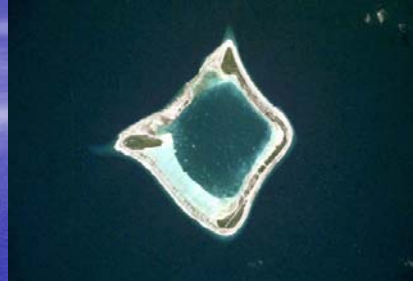
- 16 million kWh of electricity per year
- Employ 10 operators for 24/7 operation
- 200,000 cubic meters of Deep Ocean Water (DOW) per day*
- Can be self-sustaining on operating expenses based on sale of the electricity alone
- Could be designed to produce >2.4 million liters of desalinated water per day

* Would cost ~ \$4 million per year at the cost to pump water at NELHA, the only deep water research center in the world.





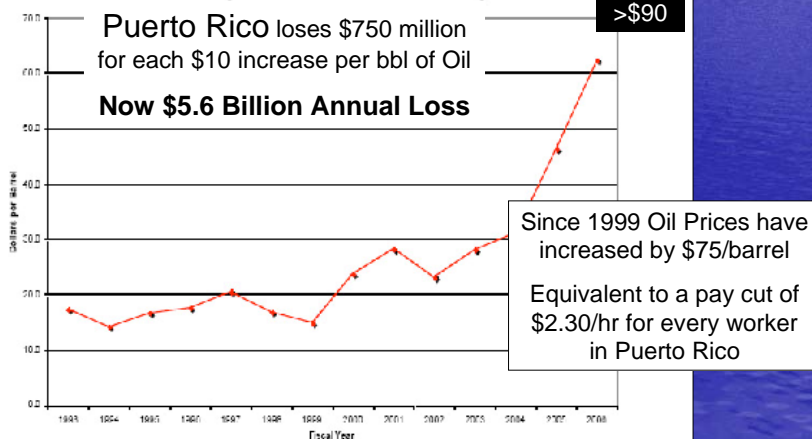
Over 20,000 Atolls in the Pacific



<http://www.oceandots.com>

A Huge Incentive to Reduce Oil Dependency in the Tropics

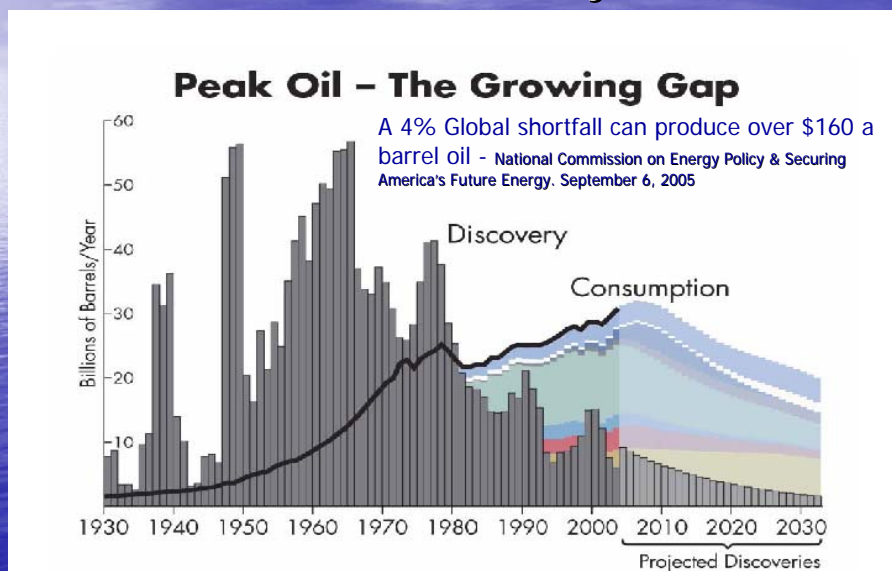
Average Price of Imported Crude Oil (dollars/barrel)



Globalization plus High Energy and Raw Material Costs have created very difficult conditions

- Despite large improvements in education levels and very competitive wage rates, many have to leave the Islands to find employment
- Unemployment in Puerto Rico is now 11.3% and the Labor Force Participation is only 47%
- 58% of children live below the Poverty Line
- Transfer Payments are in the tens of Billions of Dollars
- High Oil prices have exacerbated these problems throughout the tropics

Economic Problems Caused by Oil will Intensify

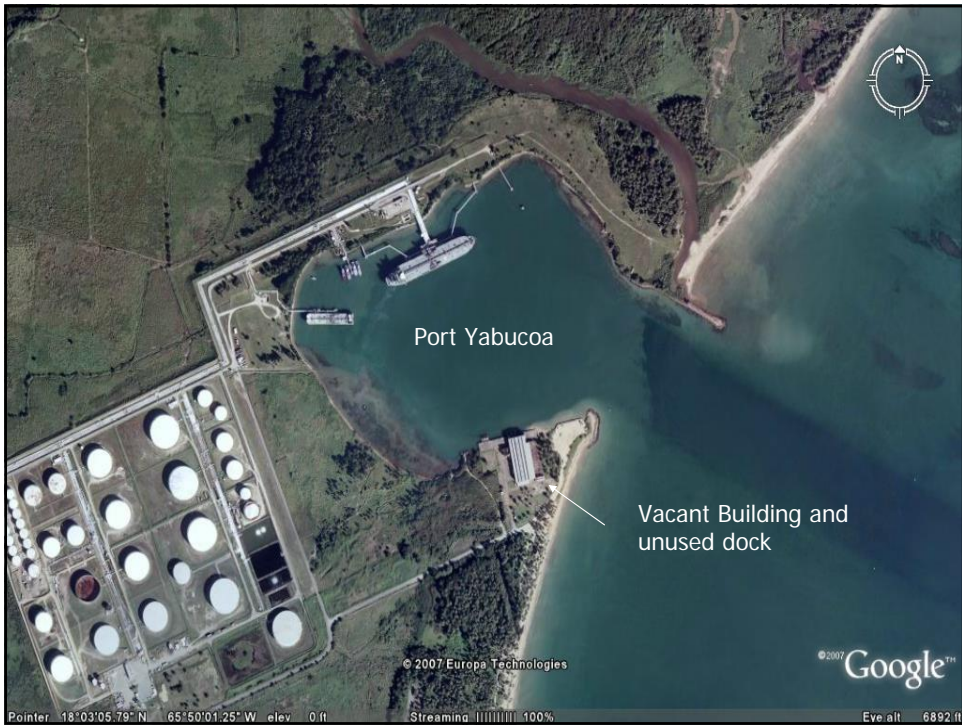
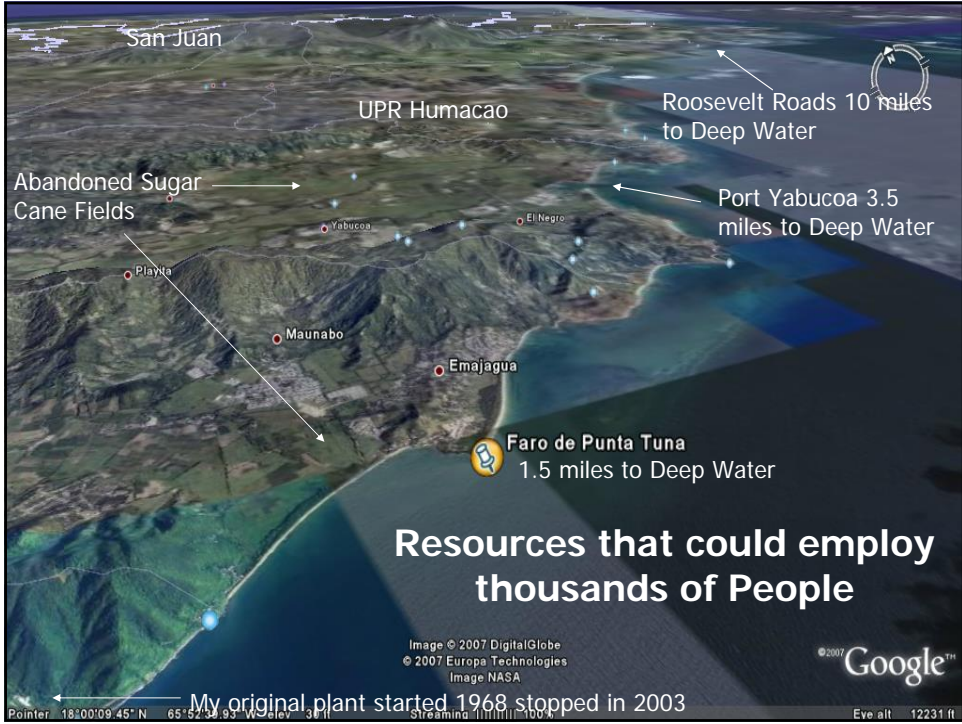


Unique Puerto Rico Assets

- The deep ocean resource near to land
- Large electrical demand on one island
- A highly educated and capable workforce of more than 1.4 million
- Facilities able to build the OTEC units
- A strong and stable financial, political and economic infrastructure with great tax benefits
- A Biotechnology capability that can revolutionize microalgae & ocean based products
- Puerto Rico can readily become the World's "Center of Excellence for Ocean Thermal Energy"

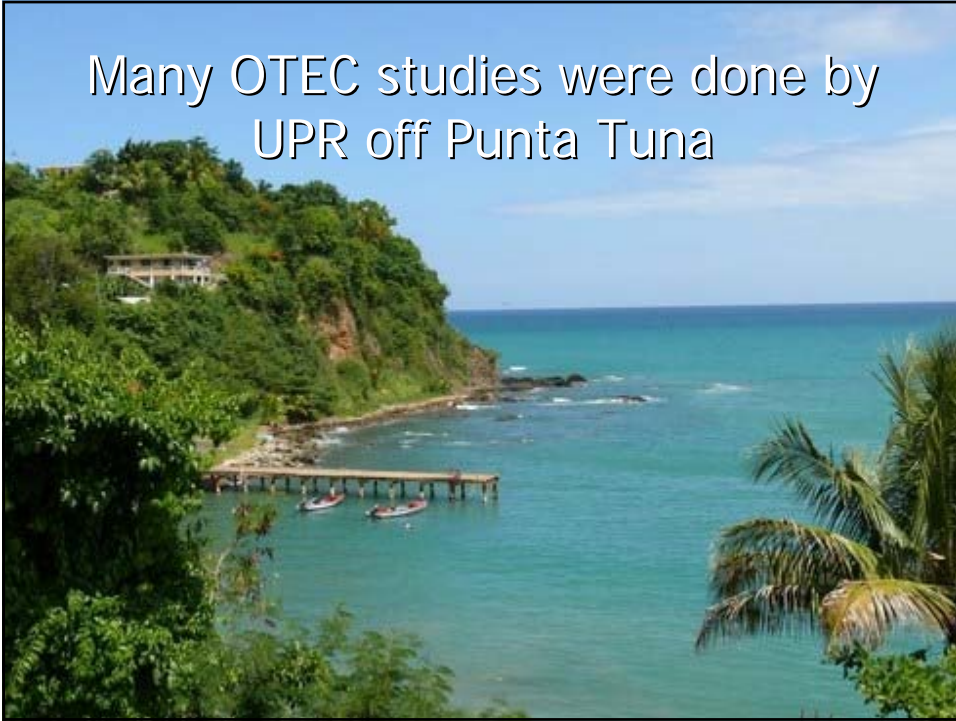
Many Critical OTEC Elements can be Manufactured and Assembled in Puerto Rico

- Power System - commercially available
 - Turbines
 - Heat Exchangers
 - Pumps
- Vessel – commercial design & construction
- CW Pipes – commercially proven to 2 M dia. Larger field tested but not in full size
- Moorings – same as for deepwater oil rigs

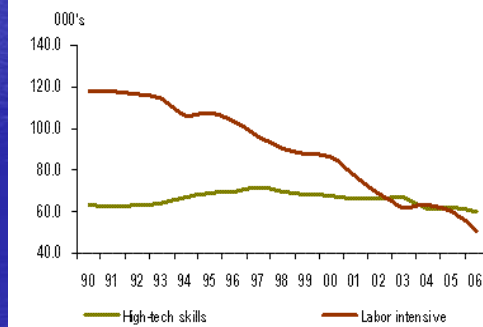
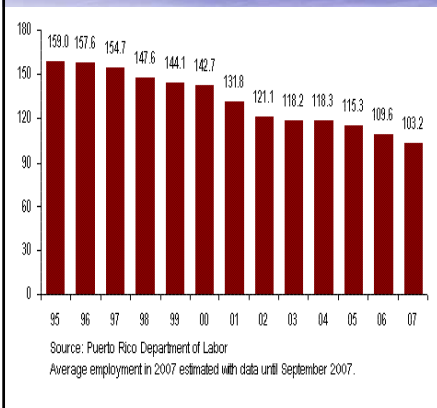


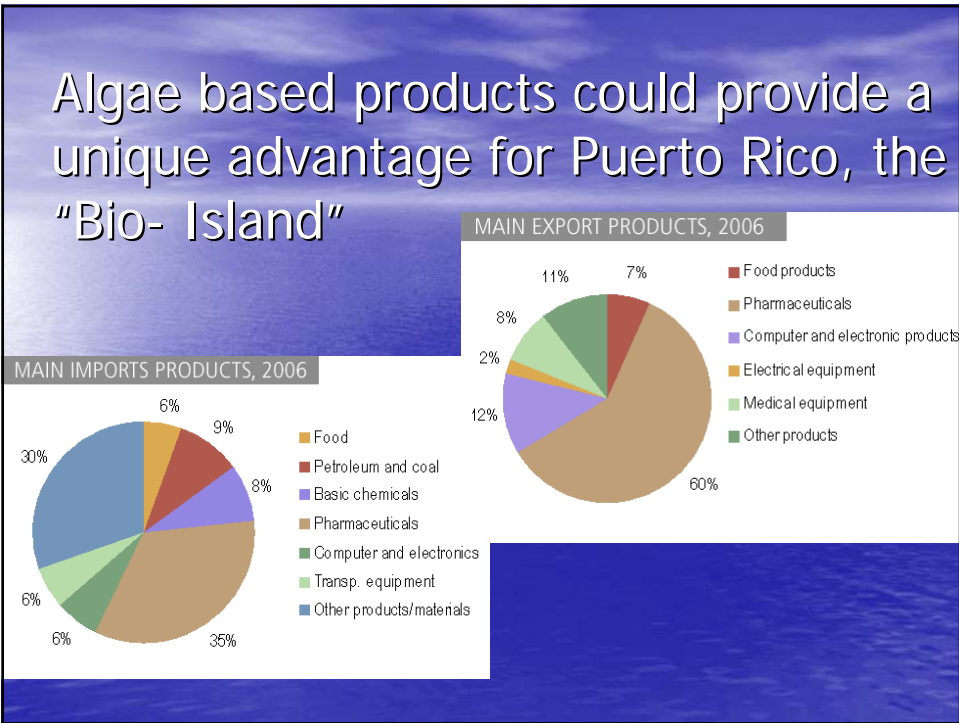


Many OTEC studies were done by UPR off Punta Tuna



OTEC can reverse the 35% loss of manufacturing jobs in Puerto Rico






Closed Micro algae production systems



There are estimated to be between 1 million and 10 million undiscovered algae in the oceans. few have been characterized.



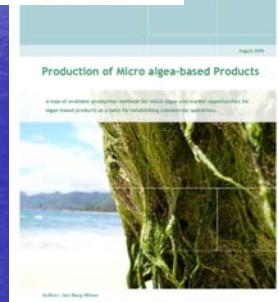
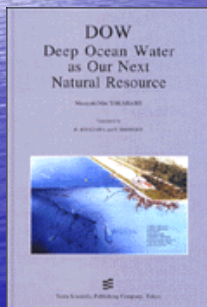
NEWS RELEASE

► SCHEDULED UNTIL 09:00 GMT TUESDAY 11 DECEMBER 2007
10:00 CET, 01:00 PST, 03:00 CST, 04:00 EST (23:00 YC/ECC HAWAII)

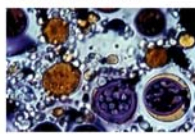
SHELL AND BP BIOPETROLEUM BUILD FACILITY TO GROW ALGAE FOR BIOFUEL

Royal Dutch Shell plc, BP PLC, Biopetroleum today announced the construction of a pilot facility, in Canada, to grow seaweed algae and produce biofuels in the commercial scale facility.

The construction is a further step in Shell's ongoing effort to develop a new generation of natural liquid hydrocarbons, a sustainable alternative to fossil fuels. The facility will be used to produce a range of services, including the use of Shell's and BP's own.



A Look Back at the U.S. Department of Energy's Aquatic Species Program:



Biodiesel from Algae

Part I:
Program Summary

Algae can produce up to 20 times the oil that can be obtained from the highest yielding land plants and does not require fertile land.

High Oil yielding indigenous algae, can be produced and processed on site for algae oil using power and discharge water from OTEC

The remaining biomass can be used as feed for aquaculture in the immediate area, also processing the seafood using OTEC produced power

Open Ocean Algae-culture and Aquaculture is possible throughout the tropics

-The deep high nutrient water from a 100 MW OTEC Plant would cost \$200 million to pump without OTEC



Many shallow areas in the Caribbean and Pacific such as the < 30 m deep 8,000 sq KM Pedro Bank off Jamaica, the thousands of km of shallows off Cuba and the atolls of the Pacific would keep the high nutrient discharge water available to grow algae and sea food from the Sun, just as occurs with natural upwelling

Atolls can provide natural
containment



<http://www.oceandots.com/lib/atolls/atollia.htm>

The OTEC Island Strategy

The most effective path to Sustainable
Economic Growth for the Tropics