Economics of Ocean Thermal Energy Conversion (OTEC): An Update

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Paper presented at the Offshore Technology Conference, Houston, Texas, USA, May 2010.
Paper Number: OTC-21016-MS
https://doi.org/10.4043/21016-MS
Published: May 03 2010

Abstract

Worldwide information indicates that although there are sufficient petroleum resources to meet demand for about 50 years, production is peaking and we will face a steadily diminishing petroleum supply. This situation justifies re-evaluating OTEC for the production of electricity, desalinated water and energy intensive products. It is postulated that the US should begin to implement the first generation of OTEC plantships providing electricity, via submarine power cables, to shore stations, followed, in about 20 years, with OTEC factories deployed along equatorial waters producing, for example, ammonia and hydrogen as the fuels that would support the post-petroleum era.

Historical estimates of investment and operational costs associated with preliminary designs of OTEC plants are summarized along with current information. These are used to estimate the cost of electricity production and assess site specific cost effectiveness. It is determined that, for example, 50 to 100 MW OTEC plants could produce cost effective electricity in Hawaii. In the absence of operational records, however, financing for such plants remains a daunting challenge. A pre-commercial plant, representing a scaled version of the 50 to 100 MW plants, must be deployed and operated to obtain the necessary records. This pre-commercial plant would not produce cost competitive electricity and, therefore, should be government funded.

Introduction: Previous Work

An analytical model is available to assess scenarios under which OTEC might be competitive with conventional technologies (Vega, 1992). First, the capital cost for OTEC plants, expressed in $/kW, is estimated. Subsequently, the relative cost of producing electricity ($/kWh) with OTEC, offset by the desalinated water production revenue, is equated to the fuel cost of electricity produced with conventional techniques[1] to determine the scenarios (*i.e., fuel cost and cost of fresh water production*) under which OTEC could be competitive. For each scenario, the cost of desalinated water produced from seawater via reverse osmosis (RO) is estimated to set the upper limit of the OTEC water production credit. No attempt is made at speculating about the future cost of fossil fuels. It is simply stated that if a location is represented by one of the scenarios, OTEC could be competitive.

Two distinct markets were identified:

1. industrialized nations; and,

2. small island developing states (SIDS) with modest needs for power and fresh water. OC-OTEC plants could be sized at 1MW to 10 MW, and 450 thousand to 9.2 million gallons of fresh water per day (1,700 to 35,000 m^3/day) to meet the needs of developing communities with populations ranging from 4,500 to 100,000 residents. This range encompasses the majority of SIDS throughout the world.

Floating plants of at least 50 MW capacity would be required for the industrialized nations. These would be moored or dynamically positioned a few kilometers from land, transmitting the electricity to shore via submarine power cables. The moored vessel could also house an OC- OTEC plant and transport the desalinated water produced via flexible pipes. It was noted that the State of Hawaii could be independent; of conventional fuels for the production of electricity, using 50 MW to 100 MW floating plants for the larger communities in Oahu, Kauai, Maui and the Island of Hawaii.

Keywords: **ocean thermal energy conversion**, **pre-commercial plant**, **levelized cost**, **oc-otec plant**, **hawai'i**, **vega**, **submarine power cable**, **electricity**, **otc 21016**, **sustainable development**

Subjects: **Environment**, **Sustainability/Social Responsibility**, **Sustainable development**

Suggested Reading

A Life Cycle Assessment of the Italian Electricity Mix: The Arcadia Database

OMC25

Ocean Thermal Energy Conversion: Strategies for system integration and implementation using commercially-available components and technology

10OTC

Ocean Thermal Energy Conversion (OTEC) an Imminent Distributed Hundred Billion Dollar Industry

25OTC

Ammonia Energy Storage, Transmission and Usage Development for Offshore Wind and Applicability to OTEC

09OTC

SS: Panel: Ocean Thermal Energy Conversion: Technical Viability, Cost Projections and Development Strategies

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