

Offshore Infrastructure Associates, Inc.:

Generating Electricity in the Tropics with Deep, Cold Ocean Water

**Hosting Sponsor:
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The Center for Economic and Environmental Partnership, Inc., will sponsor its next Washington, D.C. Energy & Environmental Funders' breakfast meeting on Friday, 1 February, 2008.

Ocean Thermal Energy Conversion (OTEC) extracts electrical energy from the warm surface waters of the tropical ocean and the cold deep water that exists wherever the ocean depth exceeds 3000 feet. (The average depth of the world's oceans is 12,000 feet, providing a huge renewable energy resource.) At the cost of some \$500 million, technical viability of OTEC was proven in the 1970s and early 1980s, and an installation functioned successfully at the Natural Energy Laboratory of Hawaii Authority during the 1990's.

Now, Offshore Infrastructure Associates, Inc. (OIA) is pursuing a major OTEC project in Puerto Rico. This has only become economically feasible recently, because of rising oil prices. OTEC is capital intensive, costing in the neighborhood of \$8 million per MW for the initial unit and declining to near \$5 million per MW by the fifth unit (this compares to estimates of \$2.5 to 3.5 million per MW for advanced coal technology). The heat exchangers, as well as the floating structures on which they reside, are very large and have to survive severe ocean conditions. (We're talking hurricanes here, since the best conditions are in the Tropics.) So while OTEC is uneconomic when oil was below \$40 a barrel, it makes sense now with oil at \$80+ a barrel and likely heading higher. As an additional advantage, OTEC is the only base load power technology that does not consume water but it can readily be designed to co-produce large amounts of fresh water.

The OTEC market is immense, covering most populated areas between 20 degrees North and 20 degrees south of the Equator. Many thousands of units may one day be spread over the tropical oceans of the world, supplying electricity directly by cable to land and indirectly through OTEC powered at-sea floating plants for producing ammonia, hydrogen, methanol and aluminum. One hundred of these units could supply 15% of all of the US Gulf Coast States while two hundred and fifty could supply all of Mexico's electrical demand. The Department of Defense could use

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them for power and water for its overseas bases, many of which are located on tropical islands, which would improve the energy security of offshore bases.

Tom Plocek, founder and president of Offshore Infrastructure Associates, Inc (OIA), and **Dr. C. Panchel**, Director of Technical Development, will discuss the technology and the company's two related commercialization projects. The first is to complete, through the preliminary design stage, a 15 MW (gross) OTEC Power Module (10-11 MW net output) using the largest existing GE ammonia turbine and both commercially available compact heat exchangers as well as advanced heat exchangers of OIA design. This effort is expected to be completed in early 2008 and can be used as the power module in 10 MW (net) land based plants as well as 40MW to 100 MW (net) floating OTEC Plants. Negotiations are underway with a major defense contractor to integrate OIA technology into its own OTEC program.

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BIOGRAPHICAL SKETCHES:

Thomas J. Plocek is founder and president of Offshore Infrastructure Associates, Inc (OIA), a company aiming at commercially developing Ocean Thermal Energy Conversion in Puerto Rico. Prior to founding OIA, he served in senior executive positions in the aroma and fragrance industry for over 30 years, most recently as Chairman of the Board of IFF Hangzhou and Vice President and Director of Aroma Chemical Strategic Planning for International Flavors and Fragrances. Earlier in his career Mr. Plocek was President and CEO of ChemFleur, Inc. a

company which built and operated aroma chemical plants in Patillas, Puerto Rico and New Jersey for over 25 years, and which was the major world supplier of several important fragrance ingredients. He has served on a number of National and International Industry Boards of Directors and has several patents and publications in aroma chemicals. He has a BS degree in chemistry from Rutgers University College in New Jersey and is a graduate of the Owner/President Management Program at Harvard University.

C. Panchal, Ph.D., Director and Principal Technical Advisor of OIA, Inc., holds a Ph.D. in Chemical Engineering from the University of Manchester, U.K., and BS and MS in Chemical Engineering from the University of Bombay, India. After working for more than 25 years at DOE's Argonne National Laboratory, he took an early retirement from Argonne and joined OIA to commercialize the OTEC Technology. He also founded a small business company, E3Tec Service, LLC, to better serve the industry. He was PI for the heat exchanger development and systems analysis of the ocean thermal program at Argonne. He developed the concept of the hybrid OTEC cycle for co-production of power and desalinated water. He designed pilot-scale test facilities, conducted laboratory and field tests, and developed new measurement sensors including the biofouling sensor used in the OTEC program. He was Argonne's PI for the biofouling/corrosion work at NELHA and designed the open-cycle heat/mass transfer test facility at NELHA. He participated in the OTEC-1 power system testing, and design reviews of 40 MWe pilot plants designs by Ocean Thermal Corp. and GE.

Dr. Panchal established and managed the thermal science and fouling research at Argonne, making it nationally and internationally recognized in this field. He participated in developing DOE roadmaps on energy efficiency and energy-water nexus. He is an AIChE Fellow Member and he actively participates in the AIChE and National Heat Transfer conferences. Dr. Panchal has published extensively on OTEC developments with authors from various fields of research; such as heat transfer, microbiology, material science, design, systems/economic analysis, and business developments. His OTEC related publications include more than 60 technical papers, 12 reports, and two book contributions.

Mr. Dennis Cooper, Program Management Senior Manager at Lockheed Martin, has 28 years of experience in the management, design, development, test and integration, and at-sea testing of large, complex submarine combat systems. Mr. Cooper has been involved in the introduction of Commercial Off-the-Shelf products for use in sonar systems onboard submarines. He is currently a member of the Program Management team developing the OTEC organization, business case and program approach for Lockheed Martin's entry back into the OTEC marketplace. He also serves as Program Manager for the Submarine Warfare Federated Tactical System (SWFTS), which performs the System of Systems Engineering and Integration for the Combat System on all US submarines. Engineering management experience includes managing the 220 person

submarine engineering organization in Manassas. The organization is responsible for the design, development, integration and maintenance of submarine electronic systems. As a Chief engineer, Mr. Cooper had responsibility for the design, development, and integration of the IDP Sonar configurations for use onboard 688, 688I and Virginia class submarines. Mr. Cooper co-chaired the Sonar IPMT group with the Navy customer. He majored in Electrical Engineering at Virginia Polytechnic Institute.