Asia Pacific Clean Energy Summit

International OTEC Symposium

Developer’s Perspective Round Table

Robert Varley

September 9, 2013
Lockheed Martin’s OTEC Roadmap

10 MW Pilot Plant

1st 100 MW Plant

100 MW+ Plants

Additional 10 MW Scale Plants

10 MW Pilot Plant Critical Step to Transition from R&D to Opening of the OTEC Market
Challenges

• Transition from research / pre-commercial to commercial
  – Significant capital costs associated with MW scale projects
  – “In the absence of operational records, however, financing for such plants remains a daunting challenge.” (Vega, 2010)

• Environmental data collection
  – Support for impact assessments

• Government support of technology development and initial projects
  – Long-term support for test beds that advance industry toward commercialization
  – Difficult budget climate
Status

• 10 MW Reignwood Group project
  – Memorandum of Agreement signed; progressing toward project start in 2013

• NELHA Ocean Energy Research Center
  – Continued Heat Exchanger deployment & testing in relevant environment

• Makai plume model
  – Support environmental assessments
Lockheed Martin and Reignwood Group to Develop Ocean Thermal Energy Conversion Power Plant

- Reignwood Group is a multinational enterprise headquartered in Beijing, China
- Strives to set the benchmark for a higher quality of life
- Invests in green related industries, products and services
  - property, new energy, aviation, agriculture, luxury lifestyle, healthcare and sports and culture

Lockheed Martin & Reignwood
OTEC Memorandum of Agreement
Signing ceremony, Beijing, China
April 2013
Multi-product commercial plant

Ocean Thermal Energy Conversion
OTEC as an Industry

Core OTEC Plant
- Generates Electricity
- Initial Market - Cable to Shore & Grid
- Larger Market - Energy Carriers & H₂O

Water Desalination
- Est 278 Tonne/MWh (RO) to 378 Tonne/MWh (Open Cycle)
  (Theoretical max = 1,160 Tonne/MWh)

Hydrogen Production
- Est 0.02 Tonne/MWh
  (1kg H₂ = 11.13 Normal m³)
  (http://planeflight.blogspot.com/2011/02/free-energy-discovered-infinite-battery.html)

Ammonia Production
- Est 0.13 Tonne/MWh
  (Assumes development of Solid State Ammonia Synthesis; electricity, H₂O & air)

Synthetic Fuels
- Est 1,020 Tonne/MWh
  (Requires development of marine algae feedstock & harvesting concept; Fischer-Tropsch process)

Energy Intensive Industries
- Locate candidate industries on OTEC-powered "energy islands"