Technip Supporting Malaysian OTEC Ambitions

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Technip Today
With engineering, technologies and project management, on land and at sea, we safely and successfully deliver the best solutions for our clients in the energy business

- Worldwide presence with over 38,000 people in 48 countries
- Industrial assets on all continents, a fleet of 27 vessels (of which 6 under construction)
- 2014 revenue: €10.7 billion

ENERGY IS AT THE CORE OF TECHNIP
An Absolute Commitment to HSES

“The Health and Safety of our people is a core value and an absolute commitment”

Thierry Pilenko, Chairman and CEO of Technip

- Technip’s global HSES climate change program
- A Reference Company in HSES (Chevron, Wheatstone, Shell Prelude, Shell Malikai, Petronas RAPID)

DELIVERING EXCELLENT HSES PERFORMANCE AT EVERY LEVEL
Malaysia Major Technip Resource Center

3,000 in Malaysia
Technip Projects:
- Kikeh
- Gumusut- Kakap
- Malikai
- Petronas FLNG1

Fleet & others: 3,400
Engineering & Project Management: 2,500
Asiaflex Products, flexible pipe and umbilical manufacturing plant: 2,500
Asia Pacific: 6,000
Fabrication – Part Owner MMHE: 4,600
Marine Vessels: 4,000
4,200
9,800
1,000

Technip globally covers the full range of OTEC technologies and delivery capabilities, and envisions OTEC facilities as a future design and delivery service.

Technip has a very strong organization in Asia Pacific, centered in Malaysia where we have maintained strong client relationships and made substantial investments.

Technip understands Malaysia’s desire to be a leader in OTEC and wants to support that ambition.

Offshore Malaysia represents an ideal environment for a demonstration plant and educational facility.
OTEC Design & Economic Issues
OTEC Plant Architecture

Technip has design engineers and supplier networks for all OTEC components.
Technip Did Designs for 5, 10 & 100 MW Net
5MW Plant Served As The Building Block
Considered Motions, Fabrication & Installation Issues For Hull Selection vs Power Capacities

- **Spar Type**
  - **Advantages**
    - Best in-situ stability for cold pipe design
    - Best operability in cyclonic regions
  - **Disadvantages**
    - Horizontal fabrication, transport, on site up-righting and topside installation
    - Access for maintenance in hull

- **Multi-Column Type**
  - **Advantages**
    - Vertical fabrication and integration
    - Relatively good stability in cyclonic regions with large deck areas
  - **Disadvantages**
    - Access for maintenance in hull
    - Low hull inefficiency for higher power capacity

- **Ship Shape Type**
  - **Advantages**
    - Lowest cost for supporting facilities
    - Drydock fabrication and quayside topside integration with large deck areas
  - **Disadvantages**
    - Vessel motions in cyclonic regions – difficult cold pipe designs

- **Caisson Type**
  - **Advantages**
    - Spar like stability – excellent operability in cyclonic region
    - Vertical fabrication, transportation and installation
    - Good hull efficiency and access for maintenance
  - **Disadvantages**
    - Fabrication sites
Resulting Installed CAPEX Curve Similar To Published Curves … But Marginally Higher

Technical Price Estimates for 5, 10 and 100 MW Net OTEC Power Plants, Installed

Differences were in integration, transportation and installation … not in hardware and hull
Majority Of Potential Users Have Positive Returns With Today’s Energy Prices

Market expected return

Source: NYU Stern School of Business for Weighted Average Cost of Capital (WACC) of Global Power Generation 2013
Malaysian OTEC
Potential for OTEC in Malaysia

- Mild environment,
- >1000m depth (Sabah Trench),
- $\Delta T > 25^\circ C$,
- <120km offshore
- Several near-by production facilities – power users
Technip Has Been Involved In Several Sabah Trough Deliveries – Know Area Well

SHELL Gumusut-Kakap Semi-Sub, Offshore Sabah (Detailed Engineering)

MURPHY Kikeh Spar Dry Tree Unit + Subsea facilities, Offshore Sabah (Engineering, Procurement, Construction & Installation)

Shell Malikai TLP, Malaysia (Engineering, Procurement, Construction)
Sabah O&G Deepwater: Technip’s OTEC Integration Plan

- Study O&G fields across entire Sabah Deepwater / Trough
- Identify power demand for each O&G DW cluster
- Identify strategies that optimize power costs considering both OTEC and conventional Gas-Fired Turbine Power Generation
- Support Petronas and PSCs to become pioneer of this hybrid solution and promote it worldwide!
Summary

- **OTEC technology is mature**
  - Ample supplier base for key components
  - Availability of advanced testing facilities

- **Economics are workable**
  - Power generation clear visible market
  - There are other less visible markets

- **Malaysia is an ideal location for OTEC industry**
  - Environment ideal
  - National resources available

**We can do this**
Thank you