SPE workshop

SPE International
Society of Petroleum Engineers

SPE VIRTUAL WORKSHOP:

Monetising Marginal Resources: Winning in the New Norm

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INNOVATIVE TOPSIDES DESIGN FOR MARGINAL FIELDS

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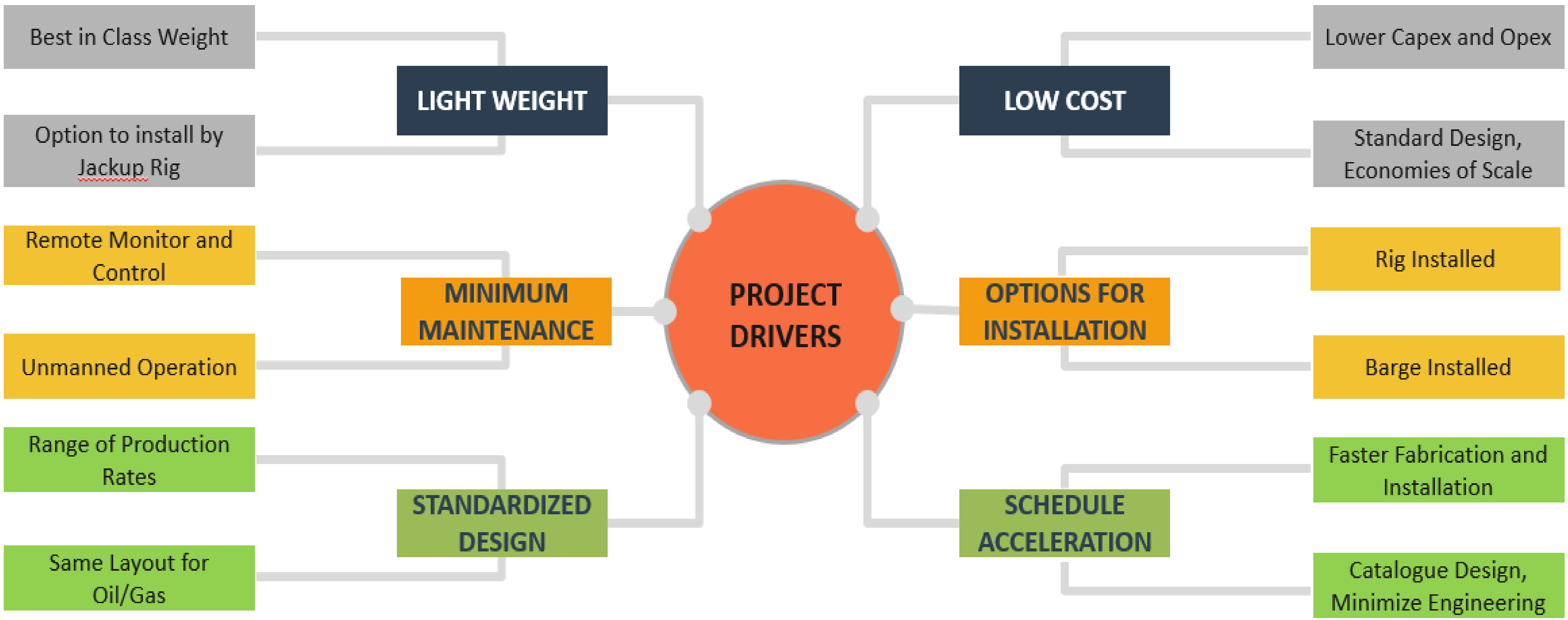
Objective

- To design a low-cost wellhead platform for developing marginal resources through collaboration with PSC (Production Sharing Contract) partners.
- To produce a Standardized Light Weight Topsides design that can be replicated for accelerated development and reduced cost.
- To use minimum functional specifications to produce a cost effective design that is significantly lighter than Malaysian benchmarks and is less than 450 MT topsides weight.

THE RESULTS

- The design is approximately 50% lighter
- Buy-in from multiple Operating companies
- One Design Good for Both oil and gas
- The Engineering completed 100% under MCO in 4 months

Drivers for Design



The above drivers were used to derive a basis of design

Design Criteria

- Topsides Weight Less than 450MT
- For Shallow Water within JUR capacity
- Topsides Fully Rated to CITHP
- Facilities Designed for 10 years
- Sized to handle 150 mmcfd gas & 8000 bpd oil
- Flexible Topsides Layout to fit different substructures
- Remote Monitoring & Control

Six Key Areas of Optimization

1) Use of International Standards
   - To focus on fit for purpose requirements and use relevant standards
   - Standardized design to allow replication by other operating companies.

2) Functional Design Approach
   - Used Basic Functional specifications and additional functionalities were rigorously challenged.

3) Reduced topsides footprint
   - Design footprint that falls within Jack-up Rig lifting envelope

4) Minimizing Electrical Power Requirement
   - To reduce topsides weight, carbon footprint and enable renewables to cater for power supply

5) Structural Design Optimization
   - Robust design to suit installation on different types of jacket

6) Lean Operations and Minimum Maintenance Philosophy
   - Designed with remote monitoring and control with operator visit frequency minimized to once a month.

Using International Standards to Maximize Value Creation

- Gap analysis conducted between International Standards (IS) and Company Standards to identify design simplification and allow replication across different companies.
- Adopted relevant International standards which contributed to weight and cost savings.
- Use of minimum technical specifications to define project requirements instead of allowing contractors to interpret company standards.
- Implemented IS as part of required compliance by incorporating in Tender documents

Functional Design Approach

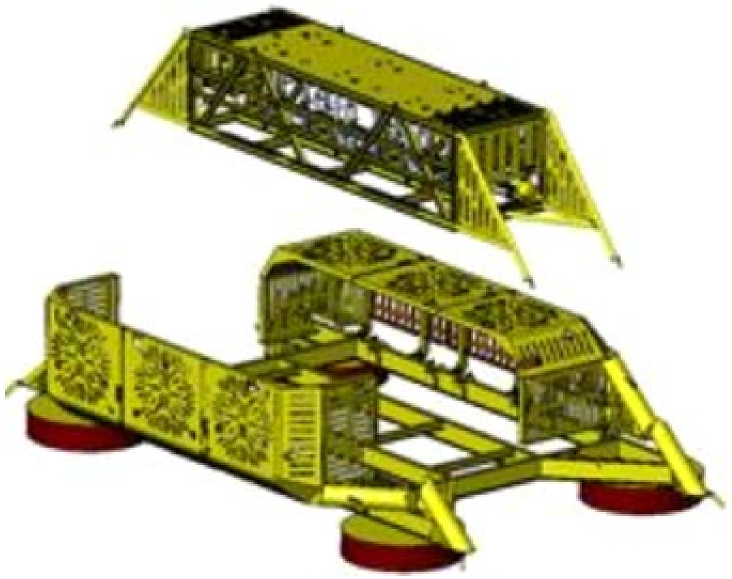
- To minimize topsides weight, a minimalistic approach to functional requirements is adopted.
- Need for added functions was continuously challenged as part of basic functionality.
- An added functionality catalogue was developed to assist Operators with specific field requirements.
- To reduce weight and associated cost, portable equipment is preferred over fixed.

Basic Functional Specifications	Added Functionality
Pressure Protection	High Alloy Metallurgy
Local Power Generation	Corrosion Inhibitor Injection
Safeguarding & Control	Pigging
Unmanned Facility	Remote Control & Monitoring
Means of Escape/Mustering	Well Testing
Communication	Drain System
Material Handling	CO_2 Snuffing

Portable Equipment	Service
Tote Tank	Diesel/Water/Methanol
Pump	Diesel / Water / Methanol
Nitrogen Bottles	Purging
Hydraulic Pump	HPU/WHCP

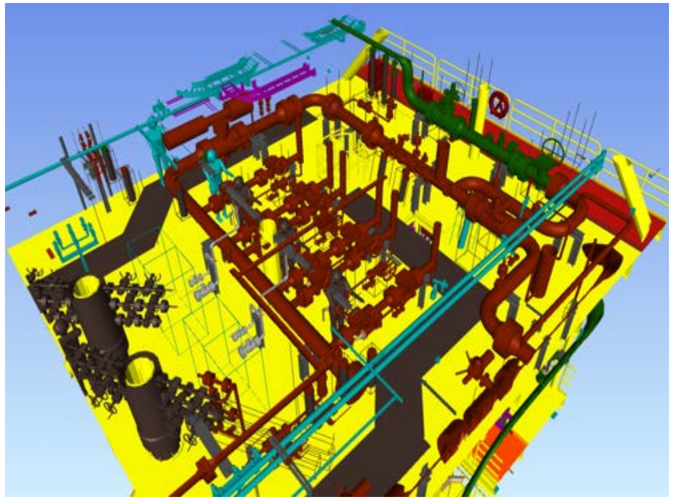
Reduced Topsides Footprint

- Use of a single topsides layout to accommodate oil or gas production
- Topside design based on a subsea layout and configured for installation by a Jack-up Rig
- Subsea Compact manifold design incorporated without compromising safety or human factor accessibility.

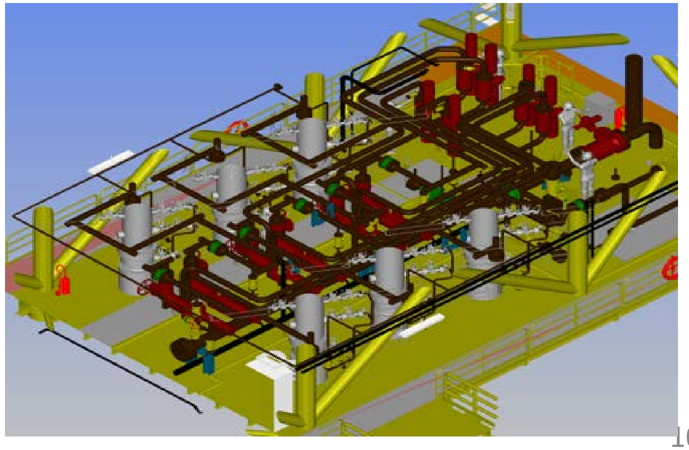


Subsea Production Manifold

Typical Production Manifold

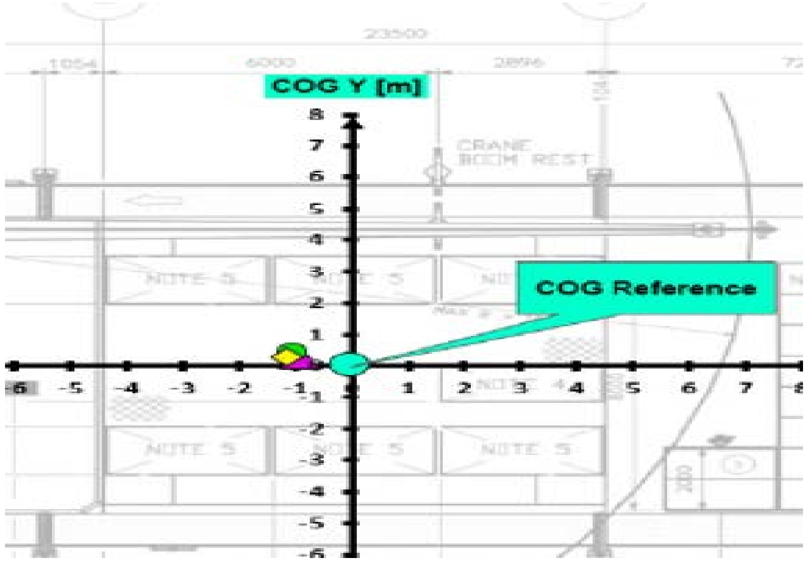


Standardized Design

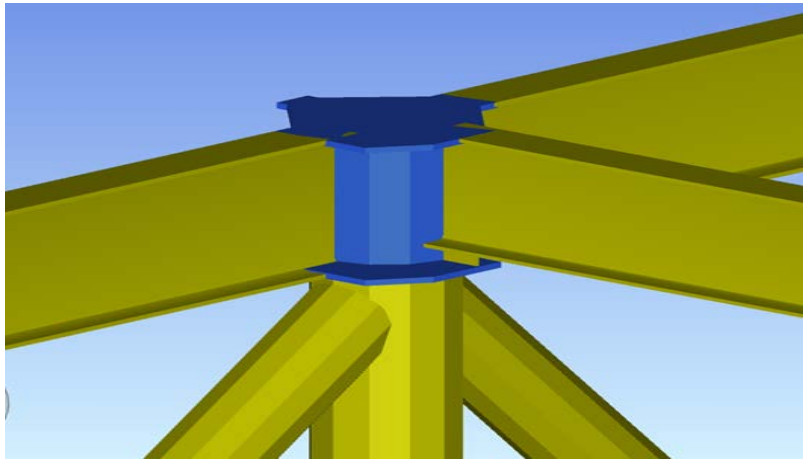


Optimization of Structural Design

- Simplification by reducing plating. Maximized gratings where permissible to allow topside weight reduction
- CoG (centre of gravity) was centered to optimize design of the four columns below the lift/support points.
- Vertical braces are configured as x-braces using thin tubulars.

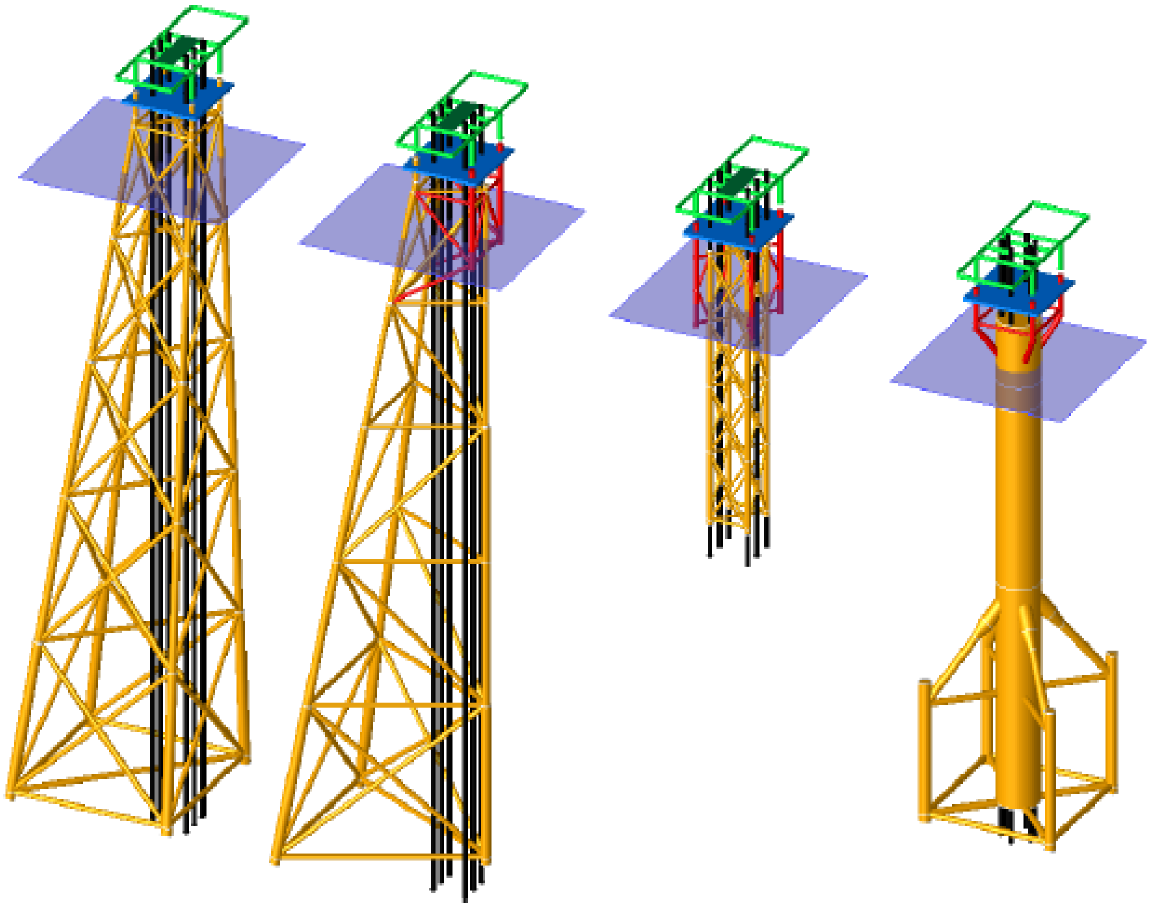


- Simple details adopted for all main joints. Top and bottom flange plates are made through with vertical columns/legs welded at the top and bottom.



Topside Design for Flexible Substructure Selection

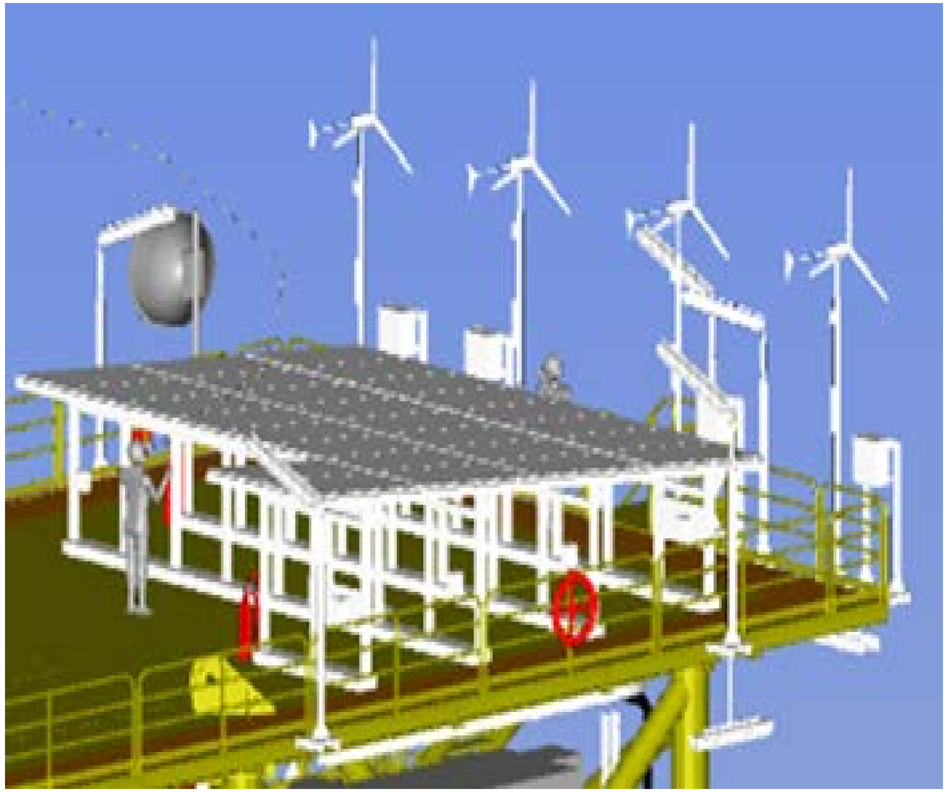
- Four support points to accommodate different types of substructures :
  - 4-legged jacket
  - Tripod Jacket
  - Conductor Supported Jacket
  - Monopod Jacket*



*Minor layout adjustment required due to central mono-column

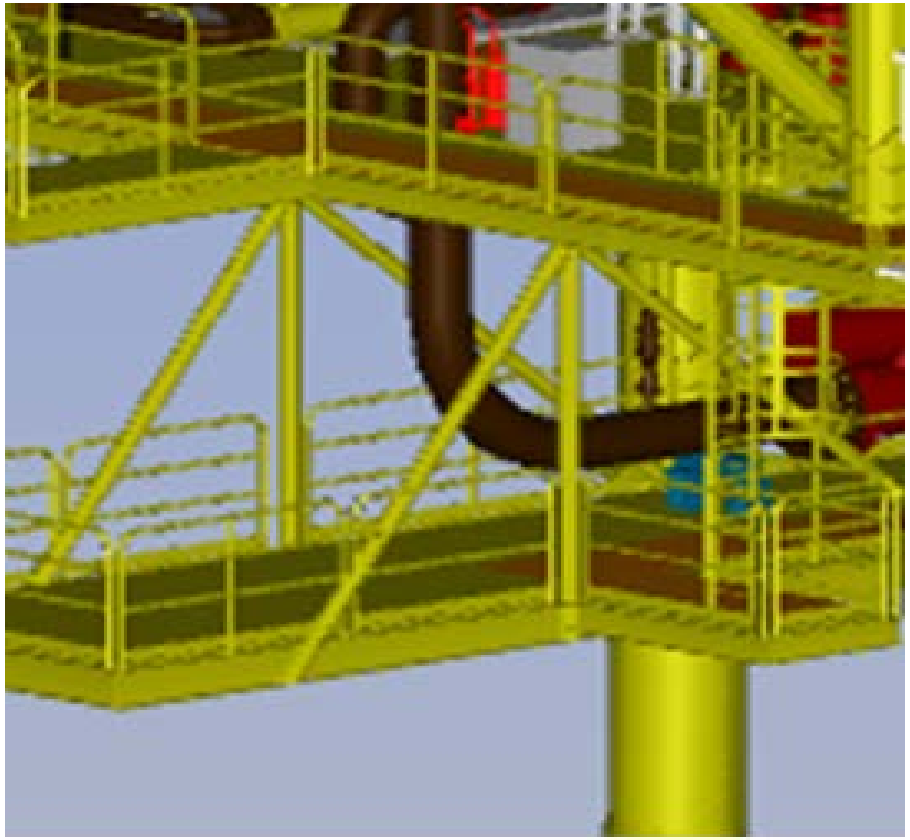
Minimizing Electrical Power Requirement

- Various sources of power evaluated including;
  - Solar Panels, Wind Turbine
  - Micro-turbine, Thermo-electric, Diesel Generator (DEG)
- Based on feasibility of low cost/weight, a hybrid of Solar Power/Wind turbine was selected.
- Through continuous optimization, power requirement was kept to a minimum of 1.3 KW.
- A DEG was used for Emergency power and non-essential loads.
- Optimization to minimize size of solar panels included;
  - No provision for CCTV
  - Number of pumps required were minimized



Design Approach to HSE in Layout

- Reduced mustering area to a minimum requirement of $0.35 m^2$/person saving weight and layout space.
- Minimized number of fixed staircases to one (replacing with monkey ladder) while maintaining all egress requirements and reducing structural weight.
- Single boat landing (at two levels)
- Keeping GHG emissions to a minimum by opting for solar panels/wind as primary power source



Unmanned Operation and Lean Maintenance

- The platform is designed to operate unmanned with remote monitoring and control
- Maximum Operator visit frequency is once a month for routine maintenance
- Well testing can be performed remotely from Host Platform with an expected frequency of once a month.
- Multi-skilled personnel used to keep POB (persons on board) to a minimum during routine maintenance.

Summary and Conclusion

- The resulting design is approximately 50% lighter than similar platforms installed in the region.
- Buy-in obtained from multiple Operating companies with varying perspectives
- Design Engineering was completed in a minimum time of four months.
- Devised an Operations and Maintenance philosophy to lower Opex spending
- Economies of scale in purchasing and installation can be obtained once the standardized design is replicated for use of all Operators in Malaysia.
- To achieve further cost reduction a robust Contracting strategy with volume discounts and long-term price agreements needs to be in place.