Technical Session

• VALSER / YANMAR GAS ENGINE GENERATOR PACKAGE & FUEL GAS SKID
• OVERVIEW OF POWER GENERATION INSTALLATION AT HESS RWHP’S

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ABOUT VALSER
- VALSER ENERGY

Valser Energy is a subsidiary company under Valser O&G which provides power generation solution for offshore and onshore oil & gas applications. We are single source provider for power generation system and solutions. Utilizing highly efficient reciprocating gas & diesel engines.

Why Develop This Unit?
During the pre-FEED work of our client’s RWHP's a higher reliability RWHP was sought. The pre-FEED work indicated that a high-reliability 20kW power source was a fundamental requirement to allow a more imaginative RWHP design than is the regional norm. With this in mind Valser Energy now supply the following products:
1. Gas Engine Generator Sets
2. Diesel Engine Generator Sets
3. Fuel Gas Systems
**Minimum Facility Wellhead Platform – A Vendor’s Perspective**

As Malaysia’s oil & gas industry enters a new phase of developments and operations, driving a requirement for light, compact RWHP installations, there is clearly a new approach required if oil operators are going to minimise risk and maximise profit.

Engineers must learn to improvise, think differently, work safely at low cost, not gold plate everything.

Valser has developed a solution for power generation requirement for remote wellhead platforms, including a Valser designed fuel gas skid system.

Some of this presentation is an overview of Valser’s recommendations of a new generation of small, minimum facility RWHP’s are to be produced to provide reliable, low cost solutions.

Though this presentation is focused primarily at gas RWHP’s, Valser are working with Yanmar to develop a larger engine capable of driving a COTP.
Main Problems With Existing RWHP’s

The largest single cause of unscheduled RWHP shutdowns is instrument gas. Widely used, due to the perception of it being free energy, entrained liquids are the largest cause of trips on RWHP’s. Instrumentation, be it field instruments or pneumatic shutdown systems, that use instrument gas are by nature less accurate and reliable than electronic instrumentation.

Also susceptible to wet gas is power generation equipment with stringent fuel gas requirements.

The above has caused innumerable production trips, usually requiring manual intervention to repair and restart. Each boat or helicopter trip introduces real and consequent safety issues in the form of boat transfers, helicopter operations, etc.

The second largest cause of RWHP trips is personnel.

A good solution would therefore eliminate instrument gas completely and reduce the input of operations personnel.
The Solution

To remove instrument gas as the prime motive force can only be done if a suitable substitute motive force can be identified. As instrument gas systems are “open” systems into which contaminants are continually flowing it would seem wise to adopt a “closed” system which, once cleaned, remains free of contaminants. Hydraulics are one such motive force, but are very consumptive of power in their operation, be that instrument gas or electrical.

The question now becomes one of selecting a power generation system that:

- maximises personnel safety
- does not cause more OPEX costs than the savings generated by the deletion of the instrument gas system
- allows the full range of operations to be carried out seamlessly
- Does not drive up the equipment list due to the inadequacy of the selected power generation system, eg; a large UPS
## COMPARISON VALSER GEG AND OTHER POWER GENERATION OPTION

<table>
<thead>
<tr>
<th></th>
<th>VALSER GEG (New Technology)</th>
<th>GEG (Others) (Conventional)</th>
<th>DEG</th>
<th>MICRO TURBINE</th>
<th>TEG</th>
<th>CCVT</th>
<th>SOLAR PANEL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware</strong></td>
<td>20kW</td>
<td>20kW</td>
<td>30kW</td>
<td>30kW</td>
<td>500 W</td>
<td>~4kW</td>
<td>~1kW</td>
</tr>
<tr>
<td><strong>CAPEX</strong></td>
<td>Valser GEG price</td>
<td>Same as Valser GEG price</td>
<td>Same as Valser GEG price</td>
<td>Approx. 1.2x Valser GEG price</td>
<td>Approx. 0.25x Valser GEG price</td>
<td>Approx. 2x Valser GEG price</td>
<td>Approx. 1.5x Valser GEG price</td>
</tr>
<tr>
<td><strong>OPEX</strong></td>
<td>Engine to be serviced every 10,000 hours. Annual 1 service visit.</td>
<td>Engine to be serviced every 500 hours. Annual 17 service visits. 17x Valser cost</td>
<td>Engine to be serviced every 500 hours. Annual 17 service visits. 17x Valser cost</td>
<td>Approx,10x cost of spares for up to 40,000 hours not incl offshore service cost</td>
<td>Est. 3x Valser cost per annum</td>
<td>Est. same as Valser cost per visit however frequency depends on gas quality.</td>
<td>Nil</td>
</tr>
<tr>
<td><strong>Motor Starting Capability</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Concerns</strong></td>
<td>Maintenance heavy causing OPEX and operation constraint. To reduce maintenance platform visit would require more unit to be installed hence CAPEX and equipment weight / space increases.</td>
<td>Not considered due to operational support requirements of diesel fuel not integrating with remote platform operational intent. Diesel bunkering and supply very expensive due to logistic cost.</td>
<td>Reports of unreliability. Microturbines are proving not reliable and plans are ongoing for change-out. Platform Gas quality greatly impact reliability. Imperfect fuel gas quickly compromises. Large footprint. Major impact on other electrical systems due to no motor starting capability. Trickle charge system, no DOL starting motors.</td>
<td>Too small to provide full motive force requirement.</td>
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<td></td>
</tr>
</tbody>
</table>

### Note 1:
The cost per visit is an estimated to include cost for manpower and spare parts involved for the maintenance work, excluding the following:

i. Personnel transportation to offshore
ii. Spare parts delivery to offshore
Next Generation Gas Engine Generators

VALSER-YANMAR GAS ENGINE GENERATORS!

- 20kW generation capacity
- 10,000 hours between services
- Major overhaul every 30,000 hours
- High efficiency, lean burn Miller Cycle engine reduces internal stresses
- Operates on process gas, up to 25% CO2 and 30ppm H2S, offering significant savings over diesel and bunkering costs
- Service limited to oil, filters and spark plug change
- Small enough to enable a cassette approach for major overhauls at Valser factory
- A small, customisable package to allow supply of items such as Fire and Gas detection and fire suppression system by Platform Fire & Gas system
- Non-hazardous area rated. For use in a safe area as clarified in PTS 31.29.90.30
- In excess of 300,000 engine units in service.
This above table illustrates the savings on total visit required for generator maintenance based on industry standard service intervals.

For an engine with typical 250 servicing hours, for 1st months of operation, minimum visit to be arrange is 2 times for engine maintenance purposes (lube oil change, filter change and etc). In one year, total maintenance visit required is 35 times.

For an engine with typical 500 servicing hours, for 1st months of operation, minimum visit to be arrange is 1 times for engine maintenance purposes (lube oil change, filter change and etc). In one year, total maintenance visit required is 17 times.

For Valser Gas Engine Generator with 10,000 servicing hours, one visit per year for maintenance purposes (lube oil change, filter change and etc) is sufficient.
Real World Implementation

Given an actual RWHP requirement of a nominal 20kW over five years the following configurations were calculated;

YANMAR (10,000 hours);
2*100% GEG’s plus 1*100% DEG.
CAPEX; Valser’s GEG price.
OPEX; Fuel gas cost plus 4 engine services.

Other GEG (250 hours);
4*100% GEG’s plus 1*100% DEG.
CAPEX; 2x Valser’s cost for GEG
OPEX; Fuel gas 2x Valser’s cost plus 180 minor service visits plus 80 major service visits over 5 years.

Other GEG (500 hours);
3*100% GEG’s plus 1*100% DEG.
CAPEX; 1.5x Valser’s cost for GEG
OPEX; Fuel gas 1.5x Valser’s cost plus 135 minor service visits plus 60 major service visits over 5 years.
Actual Savings and Lessons Learned

Compared to the running costs of the Valser GEG to the other currently available GEG’s, Valser GEG offers cost saving of eight times it purchase price over five years.

However, the greatest improvement lent to the project by the adoption of Valser’s Yanmar based generators is that of safety. Reducing from 180 platform visits to just 4 visits provides a massive improvement in EHS by a huge reduction in helicopter flights and boat landings.

From monitoring the performance of the GEG’s currently in service, after first service after 1 years operation and considering the reliability, it is clear that only 1*100% GEG is required. Valser now suggest that 1*100% GEG with an LPG bottle for blackstart and a four hour UPS is sufficient per RWHP.

This newly delivered degree of reliability and service period also begs the question that given reliable power and the need for only annual maintenance visits, what else new can now be done at RWHP’s?

The other major saving using 1*100% GEG with an LPG bottle is platform footprint and weight reduction where package size and weight is reduced by 3 times.
Food For Thought

Accepting that we now have a power generation system capable of operating unattended, continuously for over one year that provides a reliable 20kW the following options may be considered to allow a real visit period of 6 months;

• Hydraulic motive force system to replace instrument gas.
• Robust, fault tolerant PLC to provide integrated DCS/SDS/FGS functionality.
• Redundant instrumentation and key dynamic equipment.
• Provide a UPS with stand-up time related to genset servicing rather than PTS or Company requirements.
• Use platform legs for storage of corrosion inhibitor, providing duty/standby lift pumps.

Whilst cost should be a key design driver, it pays to spend more on certain areas in order to deliver a lifecycle cost saving; selective gold-plating.
VALSER TUBING-BASED FUEL GAS SKID

Simplified Piping and Instrumentation Diagram
Fuel Gas System Technology

Once Valser have the client’s gas specification they will work with their technology partners to determine the best solution. This will be either;

Conventional Separation - This method is used when there are no components in the gas that require removal or reducing in concentration. This is essentially a drying process. Due to the low flow rates involved the flow velocity is low. Therefore the required separation can be carried out in a vertical vessel of very small diameter.

Membranes - This method is used when some components require removing or reducing.

As the maximum fuel gas flow rate is 5scm/hr at 0.03BarG the fuel gas skid can be made using instrument tubing. A footprint of 1-5~2.0m3 is sufficient.

The major saving in using ‘Valser Tubing-based Fuel Gas Skid’ is platform footprint and weight reduction where package size and weight is reduced by more than 10 times.
Achievement of Safe Area Zone
THANK YOU

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OVERVIEW OF POWER GENERATION INSTALLATION AT HESS RWHP’S (KESUMBA, BERGADING-C AND BERGADING D)
Installed power generation configuration:
2 nos of 20 kW Gas Engine Generators + 1 nos of 40 kW Diesel Engine Generator at 400VAC, 3-phase, 50 Hz.

- Normal Unmanned Operation (Single GEG Running) ~ Designed for maximum 19.5 kW, continuous load ~ 10kW
- Normal Manned Operation (Both GEG Running & DC UPS Float Charge) ~ Designed for maximum 37 kW, continuous load ~ 22kW
- Black start Operation (Only DEG Running & DC UPS Float Charge) ~ Designed for maximum 37 kW, continuous load ~ 22kW
Modes of Operation

Unmanned Mode:
- One GEG running with other GEG on standby.
- Auto initiation of changeover between both GEG’s every two weeks.
- Auto start-up of standby GEG when power exceeding set load
- Auto start-up of DEG when both GEG fail or in case of fuel gas system fails
- Auto start-up of DEG on periodic no load test run

Manned Mode:
- Either two GEG’s or one DEG running due to cover loads required for maintenance loads.
Key Single Line Diagram
Power Generation Layout
End User Feedback

1st Annual GEG PM completed back in August 2018 for all 6 units as per schedule.

- Lubricating oil
- Air cleaner element
- Spark plugs
- Coolant
- Salt air filter
- Pressure regulator
- Gas hose
- Control & starting batteries

Auto switchover between duty and standby GEG’s on bi-weekly basis as per design

Areas for improvement:

- Fine tuning of auto switchover settings
- Sizing of auxiliary components i.e. miniature circuit breakers for Control & Synchronization Panel (CSP) and control/ starting batteries.
- Digital Automatic Voltage Regulator (AVR) instead of mechanical AVR
- Access to batteries
- Remote complete mapping of power generation parameters to CPP.
THANK YOU