Case study: Offshore Cambodia, Gulf of Thailand

Artificial Lift technology, expertise, infrastructure produced first oil in Cambodia in less than two months

In December 2020, Cambodia achieved a historical milestone: the first oil production well in the Gulf of Thailand. The customer in the Apsara field faced substantial challenges, including extremely high operational costs, outdated infrastructure and logistical systems, and the limitations caused by the Covid-19 pandemic. The specific reservoir conditions also proved challenging, with a high reservoir pressure of 3,100 psi (21.3 MPa) and a temperature of 306°F (152°C). Knowing Baker Hughes has extensive experience with electrical submersible pump (ESP) and artificial lift technology and possesses a strong presence in the Gulf of Thailand, the customer reached out for a solution.

With the limited space available on the platform, Baker Hughes provided six sets of Surface 208KVA **Vector Plus™ variable speed drive (VSD)** surface control systems and six sets of downhole **CENtrilift™ FLEXPump™ ER series ESP pumps** to support the project. Specifically designed to optimize artificial lift systems, the Vector Plus VSD simplifies pumping operations and maximizes run time as well conditions change by providing more precise motor control of downhole ESPs. The FLEXPump series pumps incorporate innovative hydraulic design concepts to expand the application range of ESP systems. These efficient, reliable pumps have the industry's widest operating range, providing customers with the flexibility required in dynamic well conditions to minimize ESP system changeouts and nonproductive time (NPT), while reducing operating expenses.

The estimated downhole temperature of 306°F (152°C) proved a challenge to standard ESP equipment. Baker Hughes engineers opted to change some of the downhole components by including an oversized extreme performance motor to reduce temperature rises and prolong run life. To handle the high temperature conditions, the lube oil was changed to CL7, and a high-temperature downhole gauge capable of 347°F (175°C) was selected to ensure all downhole parameters were monitored.

In addition, Baker Hughes mobilized six field service specialists and installation tools to support equipment preparation in Cambodia. Complicating the typical offshore delivery challenges and the confined space on the rig deck, this operation was conducted during the Covid-19 pandemic which limited logistical and personnel movements.

The plan was to drill five development wells with a true vertical depth (TVD) between 8,100 and 9,100 ft (2468 to 2773 m) subsea, or a measured depth (MD) from 10,500 to 13,500 ft (3200 to 4114 m). The maximum well inclination was 62° with bottomhole temperatures reaching up to 306°F (152°C). The five wells comprised more than 56,000 ft (17 068 m) of total drilling.

Less than two months after the flawless execution of the first installation, the Apsara field achieved

Challenges

- Extremely high operational costs
- Outdated infrastructure
- Covid-19 pandemic limitations

Results

- Achieved first oil less than two months after installation
- Mobilized personnel and equipment during Covid-19 pandemic via regional support facilities and excellent resource management
- Saved time and associated costs on personnel movement, and equipment transportation
- Experienced no health, safety and environmental (HSE) issues or NPT

first oil in Cambodia. The oil began flowing from a single development well with an estimated production rate of 1,200 BOPD (7.95 m^3/d).

The production rate is expected to reach a peak flow rate of 7,500 BOPD (49.6 m^3/d) when all five wells have been drilled and commissioned.

Baker Hughes is committed to continue providing onshore and offshore service for the customer.