Betting on Hebron

First oil from ExxonMobil's giant Hebron project off Newfoundland and Labrador is set for 2017. Sarah Parker Musarra received an update on the development from Geoff Parker, Hebron senior project manager, and examines its place in the Canadian energy economy.

After its 1980 discovery, the giant ExxonMobil Canada-operated Hebron field is getting its sea legs. With first oil planned for 2017, Hebron will then become the fourth field producing in the frigid waters of the Canadian province of Newfoundland and Labrador.

Hebron is a heavy, 20°API crude oil project located in the Jeanne d'Arc basin about 350km southeast of the capital St. John's, in water depths ranging from 88 to 102m. According to the project's development plan, the asset currently contains three fields discovered in the early 1980s: Hebron, West Ben Nevis, and Ben Nevis, which housed Hebron's initial oil discovery. These fields span four significant discovery licenses: Hebron SDL 1006, Hebron SDL 1007, Ben Nevis SDL 1009 and West Ben Nevis SDL 1010.

Hebron will tap four reservoir intervals, which are structured into several normal fault-bounded fault blocks. The four reservoirs, which are vertically stacked with multiple fault blocks, are the Late Jurassic Jeanne d'Arc formation, the Early Cretaceous Hibernia formation, the Early Cretaceous Avalon formation and Early Cretaceous Ben Nevis formation.

ExxonMobil Canada Properties operates Hebron with 36% interest. Its partners on the development include Chevron Canada Ltd. (26.7%), Suncor Energy Inc. (22.7%), Statoil Canada (9.7%) and Nalcor Energy (4.9%). ExxonMobil assumed the operatorship from Chevron in 2008, and announced its intent to develop the field using a gravity based structure (GBS) in January 2013. At that time, the supermajor revealed that by using the GBS it will be able to recover more than 700MMbo, up from earlier estimates of 400MMbbl, from Hebron.

Developing a field estimated to produce such volume comes at a price, and Hebron's cost is approximately US$14 billion, following the increase in recoverable reserves.

"This is expected to be the most capital-intensive fixed platform development globally for 2015," says Catarina Podevyn, published content analyst for energy analyst firm Infield Systems.

Hebron is not just the most capital-intensive project globally: This is also true for the Arctic region over the next five years, Podevyn says. "It will form 41% of the region's capital expenditure for 2015," she says.

Hibernia to Hebron

The unrelentingly harsh environment off Newfoundland and Labrador is among the world's most severe. During the province's brutal winter months of November through March, Newfoundland and Labrador's tourism board places the high temperature range between 1 and -8°C and the low range between -6 and -18°C.

These extreme meteorological and oceanographic conditions would stand to dictate the field's development plan. ExxonMobil has extensive experience operating in Arctic environments, but some of its most applicable experience to the Hebron field was in the project's own backyard: Hibernia. Many lessons have been gleaned from the long-producing field.

"We had the benefit of having developed Hibernia in the 1990s and applied learnings from that project, as well as several other GBS projects we have executed since Hibernia. We have paid special attention to the constructability of the GBS design, and have configured the GBS taking into account the latest technical developments in wave and ice loading," Hebron Senior Project Manager Geoff Parker says, pointing to the offshore loading system (OLS) as one example. "Hibernia had a system that was replaced recently because the components in this harsh environment can be subject to fatigue. Hebron will use a system similar to the new system installed on Hibernia," he says.

Hebron's OLS is a closed loop design; two main pipelines will run from the GBS to two separate riser bases. The design allows for round-trip intelligent pigging and flushing operations through the pipelines and pipeline end manifold if an iceberg threatens the loading facilities.

Hebron GBS specs

Water depth (mean sea level)	93m
Height	120m
Diameter of GBS base	130m
Shaft diameter	35m
Concrete volume	130,000cu m
Well slots	52
Storage	1.2MMbo
Production capacity	150,000b/d
Offloading rate	34,000bbl/hour

Sources: Kvaerner / ExxonMobil

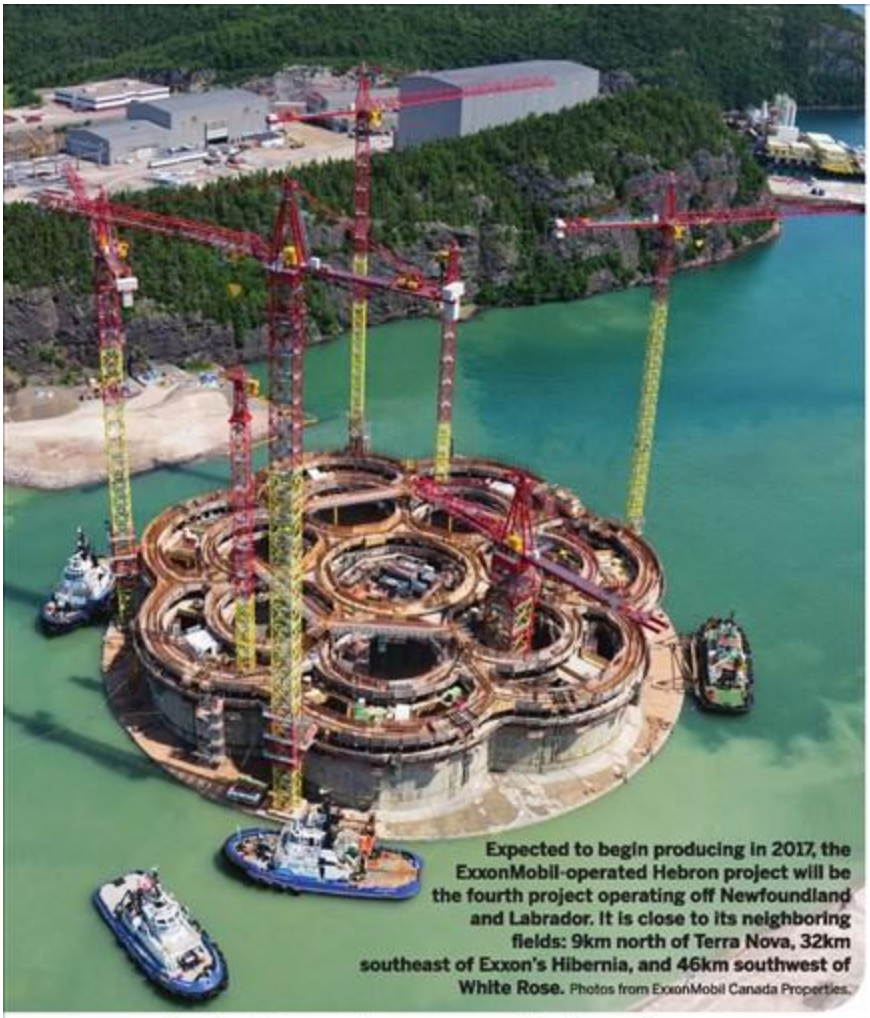
Production and Hebron's GBS

Like Hibernia, Hebron will produce through a GBS, which has an in-service design life of at least 50 years.

Engineered and constructed by Kiewit-Kvaerner Contractors, a joint partnership between Peter Kiewit Infrastructure and Kvaerner Newfoundland as part of an overall engineering, procurement, installation and construction contract for the development, the reinforced concrete-GBS has 52 well slots and is capable of operating in an average water depth of 93m. It has production capacity of 150,000b/d and is capable of storing around 1.2MMbo.

The environment remains a constant issue to contend with. Two different forms of floating ice – sea ice and icebergs – are present in Hebron's offshore marine environment, Parker says.

He explains that parts of nearshore construction at Bull Arm, such as major concreting work, was done outside of the winter months. The GBS will remain floating during parts of the construction and installation phases, so stability is critical even when construction is suspended



Expected to begin producing in 2017, the ExxonMobil-operated Hebron project will be the fourth project operating off Newfoundland and Labrador. It is close to its neighboring fields: 9km north of Terra Nova, 32km southeast of Exxon's Hibernia, and 46km southwest of White Rose. Photos from ExxonMobil Canada Properties.

temporarily. The GBS' unique design is, he explains, a function of the various construction stages as well as the production phase.

"The GBS is designed to withstand impact from both sea ice as well as icebergs. Nevertheless, once the platform is installed offshore, Hebron will participate in an existing ice management program which monitors both sea ice (pack ice) and icebergs," Parker says. "Individual icebergs are identified and tracked by aircraft and platform radar from considerable distance away from the platform. If an iceberg's drift path is likely to intersect with the platform, the iceberg is diverted by towing or, for smaller icebergs, using vessel fire-fighting cannon or propeller wash to re-direct it. Sea ice is monitored for information to vessels supporting the platform, such as supply vessels.

Parker says that the team ruled out an alternate plans including subsea wells tied back to the Hibernia platform; an FPSO in combination with subsea wellheads; and an FPSO in combination with wellhead gravity base structure.

"An extensive process was undertaken to review alternative development concepts for the Hebron Project. The project proponents evaluated the alternative modes of development and determined that the preferred concept was to develop the Hebron asset using a stand-alone concrete GBS with oil storage, plus a topsides including processing and drilling facilities, and an OLS," he explains.

The development celebrated its most recent milestone on 23 July, when the GBS was towed from dry dock to its Bull Arm deepwater construction site. The 180,000-tonne structure arrived 10 hours after tow-out operations began. Construction began in dry dock during October 2012.

Since the towing, mooring lines have been attached to the structure, Parker says. After that was completed, the flotilla was put into place around the GBS to prepare for the next phase of construction. The concrete slipforming for the next construction phase started in September.

According to the project's development plan, the GBS' modular topsides, with a nominal design life of around 30 years, will include a drilling support module, a derrick equipment set, living quarters, a flare boom, and a utilities and processing module. One main shaft will support the topsides and encompass all wells.

The bigger picture

The US Energy Information Agency places Canada as the fifth greatest energy producer in the world; however, Atlantic Canada's production is all offshore, meaning that its energy economy is different from the rest of the country. And the forces driving that economy are aging, although continued drilling on satellite fields contribute to keeping production rates relatively stable. When it enters production, Hebron will be the newest producing project in the basin by a significant margin. Nestled within a cluster of long-producing crude fields – Exxon's Hibernia, Suncor's Terra Nova, and Husky Energy's White Rose – hopes are pinned on the Hebron field as the production from aging fields slowly dwindles.

Hibernia started up in 1997 through a GBS. Terra Nova and White Rose came online in 2002 and 2005, respectively, through floating production storage and offloading units (FPSO) units.

According to the Canadian Association of Petroleum Producers' (CAPP) June 2014 Crude Oil Forecast, the area's production is expected to hold at levels above 200,000b/d until 2024, with that rate supported by Hebron and the existing trio of assets' satellite fields. By 2030, it is expected to decline to less than 100,000b/d. CAPP notes on its website that that the currently producing facilities in Atlantic Canada have been in operation for a minimum of seven years, with some fields in production since the late 1990s, thus leading to a decling in production.

Annual production levels, also provided by the CAPP, show a peak in the Atlantic Provinces' production in 2007 at 381,000b/d. Production has fallen off significantly since then, with a decline almost every year.

According to the association, the area's production levels in 2013 clocked in at 231,000b/d.

The news isn't all bad. According to Tom Ziegler is Vice President of Global MultiClient at Petroleum Geo- Services, the area offshore Newfoundland and Labrador contains an untapped potential with an estimated 6 billion bo and 60Tcf of natural gas yet to be discovered (OE: January 2014). **OE**