Petroleum Development Oman (PDO) reports that Shell Global Solutions’ patented in-line separator (ILS) is operating successfully at its remote Musallim oil field in Oman. This low-cost, low-complexity technology separates water from crude oil and gas by using an enlarged production-gathering header as a pipe separator. It has cut PDO’s running costs by reducing the amount of equipment that needs to be operated and maintained compared with a conventional gathering station.

Like many fields worldwide, the Musallim field produces substantial amounts of water as a by-product of crude oil extraction and requires water injection to balance reservoir depletion and maintain production pressures. PDO considered several options for surface development, including a conventional gathering station with a production separator, degasser, dehydration tank, gas compressor, water injection pumps and oil export pumps.

After a thorough economic and technical evaluation, PDO became the first operator to adopt the new ILS technology. “The other options required higher capital expenditure,” says Ahmed Balushi, PDO process/concept engineer. “A key feature of the ILS is that it allows oil–water separation to take place under pressure at relatively low cost. In the case of Musallim, this has allowed us to make full use of the available pressure generated by the producer wells’ electrical submersible pumps – such that the water separated in the ILS is directly reinjected into the reservoir without the need for surface pumping. Similarly, the separated oil and gas are directly exported by multiphase pipeline. The surface facilities are therefore considerably simpler than those of a conventional gathering station and consequently require little attention.”

Crucially, the quality of the separated water is good enough for it to be reinjected into the reservoir. “Before the ILS went online there was some uncertainty over the water quality that would be achieved in practice,” recalls Balushi. “In fact, we had defined a pending project to retrofit hydrocyclones as a further water-polishing step. However, the ILS routinely exceeds the target oil-in-water specification of 50 ppm v/v so we have cancelled the hydrocyclone project.”

Eric Puik, process engineer*, Shell Global Solutions International BV, explains the ILS design philosophy: “Water naturally separates from oil and gas when it is being transported from the well to the central production station,” he says. “The water sinks to the bottom, the oil flows in the middle and the gas rises to the top. This is the principle behind our in-line separator. We allow natural separation to occur, then we cream the oil and gas off the top. It is a very simple and elegant solution.”
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