

# Flow Rate Metering for SAGD Production

## Applications

Production well testing under challenging conditions

- Extra heavy oil or bitumen production
- Extremely low gas rates
- Low density contrast between the produced liquids
- Wells with instabilities, such as slug flow, causing carry-over or carry under

## Benefits

- Cost reduction by optimization of steam-assisted gravity drainage
- Better estimation and recovery of reserves
- ESP optimization for extended life cycles
- Operational and environmental risk reduction
- Elimination of concern over contamination by effluents after separation

## Features

- More repeatable and accurate measurement than provided by conventional well testing
- Exceptional dynamic response
- Measurement delivery in real time
- No need for separation and flow calibration
- Accuracy of measurements unaffected by foams or emulsions

## Vx technology can now be applied to thermal extra heavy oil and bitumen production

Vx<sup>†</sup> technology has been extended to provide an optimized multiphase flow rate metering solution for thermal extra heavy oil (EHO) and bitumen production.

Steam-assisted gravity drainage (SAGD) is an exploitation technique wherein parallel horizontal wells are drilled several meters apart. Steam is injected through the upper well, and EHO or bitumen, water, and steam drain into the lower producing well. Extremely high temperatures and the introduction of steam as a fourth phase in the surface production stream are challenges unique to this type of oil production, and they are challenges that multiphase metering technology had been unable to address. Until now.

### The Limitations of Separator Measurements

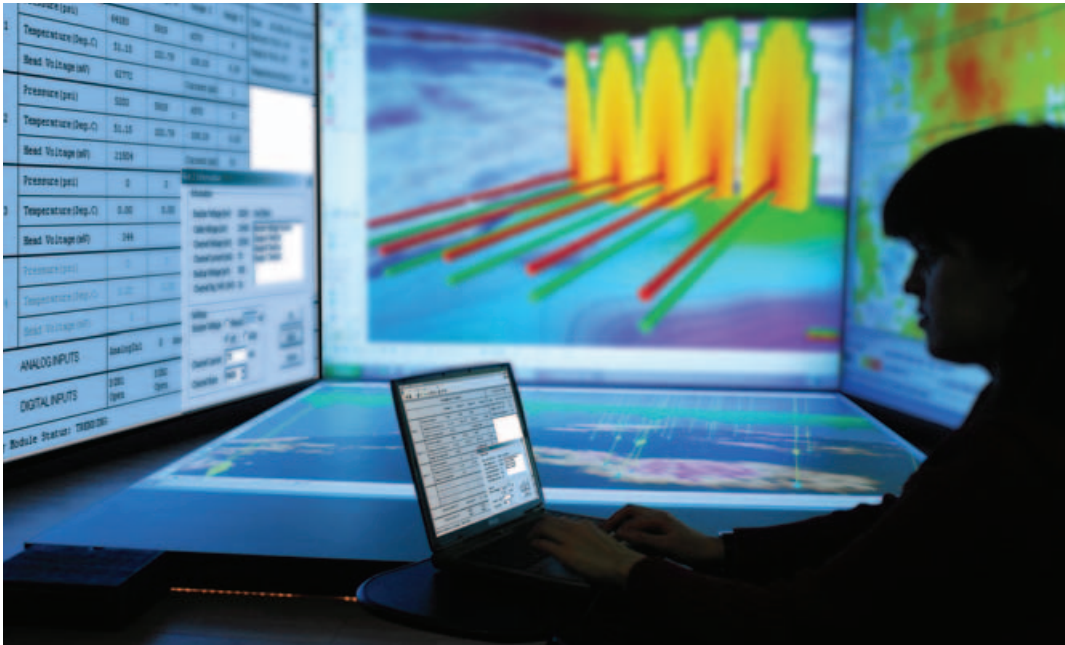
In SAGD production well testing, poor separation of the phases severely compromises separator measurements of gas and liquid flow rates. In EHO and bitumen environments, standard separators are particularly hard-pressed to measure flow accurately because of extremely low gas rates, high viscosities, minimal density contrasts between fluids, contamination by different effluents after separation, and well instabilities that lead to carryover or carry under. Moreover, the large pressure drop that occurs when fluids pass through the separator alters production. Well testing results obtained with a test separator may not reflect actual production conditions.

Viscous fluids are retained in the separator for longer periods and cause gas to be trapped in the liquid stream. Emulsions and foam in the liquid stream may require injection of a demulsifier, increasing logistical requirements and further complicating operations.



*With minimal footprint and onsite installation needs, the PhaseTester\* service with Vx technology reduces costs through efficiency and uncomplicated logistics.*

# Flow Rate Metering for SAGD Production



Computer-generated display showing the challenges of SAGD flow measurements. Steam is injected in the upper wells (red) and heavy oil or bitumen, water, and steam drain into the lower producing wells (green).

## How Vx Technology Addresses the SAGD Challenge

With Vx technology, separation is not required for flow rate measurement.

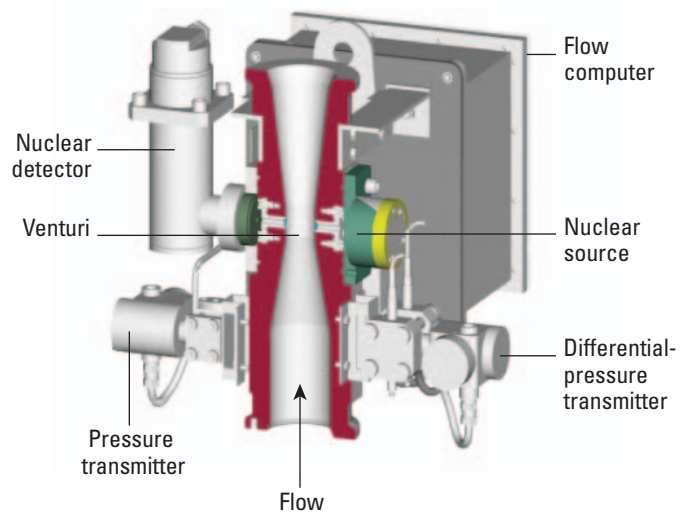
This advanced multiphase flow-meter technology has been extended for SAGD applications through the addition of special field-proven procedures, an application-specific interpretation model, and a fit-for-purpose fluid properties package.

Vx technology has been engineered to operate at the higher temperatures typical of SAGD production, measure the higher oil viscosities typical of EHO and bitumen, and account for steam at line conditions through fluid property modeling and processing.

Because Vx technology measurements are based on a nuclear mass attenuation principle, they distinguish fluids by their compositions rather than their densities. Therefore, they can accurately measure the phase holdups to differentiate water from EHO or bitumen.

Further Vx technology uses a specific fraction measurement technique that enables accurate multiphase flow measurements, even in the presence of foams or emulsions typical of heavy and viscous oil environments. Vx technology can be deployed efficiently with PhaseTester portable testing skids or PhaseWatcher\* permanent monitoring equipment.

Schlumberger offers a full suite of sampling and fluid properties testing services to ensure accurate Vx flow-rate calculations and complete fluid characterization for optimized reservoir and production evaluation.



The design of the Vx flowmeter venturi section ensures accurate measurements of individual flow rates, even in challenging SAGD operations.

[www.slb.com/welltesting](http://www.slb.com/welltesting)

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