

**AAPG Annual Convention  
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**An Economic Development of Extra Heavy Oil from Thin Heterogeneous Sands, Requires Complex Horizontal Well Geometries, Faja del Orinoco Venezuela**

Petrozuata's concession, located in the Faja del Orinoco of Venezuela, produces heavy oil from fluvial, distributary and estuarine channel deposits. This mixture of depositional environments creates heterogeneous reservoirs with highly variable patterns of sand distribution. Challenged with poorly-connected reservoirs and the need for high flow rates per well, Petrozuata custom designs multilateral horizontal wells to access thin, laminated sands and contact stranded reserves.

As part of an accelerated development program, in excess of 3.1 million feet of hole have been drilled in four years. Complex, multilateral horizontal wells are designed utilizing extensive reservoir characterization studies and then geo-steered to mechanically connect sand bodies.

Though Petrozuata has drilled various types of multilateral horizontal wells, the fishbone well is clearly the most complex design, and yields a massive amount of 3 dimensional information about the thickness, lithologic variation, and areal extent of the sandstones. Fishbone wells consist of a spine or main lateral with 6 to 12 upward-trending, off-branching laterals ("ribs"). The ribs are designed to penetrate the vertical flow barriers in laminated sands, and to drain isolated sand lenses. Some extended-reach fishbones have penetrated over 400' of vertical section above the spine, thereby exploring shallower zones..

The average multi-lateral fishbone well includes a network of over 20,000' of open hole. The single well record exceeds 63,000 feet. Using multilaterals, Petrozuata has increased the oil rate and ultimate recovery per well, while decreasing the cost per barrel in one of the world's largest and most complex multilateral developments.