A multitude of production options exist to produce heavy oil. Each one, depending on the type selected, has its advantages and disadvantages. In addition, a production option selected today may not necessarily be optimum or even appropriate for production some time in the future depending on the recovery technique used. Prior to even selecting the production method, an understanding of the produced fluid properties is required for not only current in-situ conditions, but also those that may (or will) occur as the development and recovery strategy matures. For example, if the recovery process selected consists of a steam drive, the fluid produced will initially be at reservoir temperature and may also be at a very low water cut. As the steam drive progresses, the water cut may increase with time as will the producing temperatures. In this instance, the viscosity and temperature impact on the production equipment is substantial. Of particular concern is whether the producing conditions fall outside the operating envelope of the artificial lift equipment used.

Predominantly, there are three main artificial lift types used in heavy oil production. They include sucker rod, progressive cavity and electric submersible pumps. Other artificial lift types such as gas lift, plunger lift, hydraulic jet, hydraulic piston and even steam lift are used but to a much lesser extent than the aforementioned lift types.

The most easily recognizable production method used in heavy oil is the sucker rod pump. These are the oldest, simplest and least expensive of the artificial lift systems when considering life cycle cost. Production from this type pump ranges from stripper wells to thermal production wells operating at down hole temperatures exceeding 500 ºF. Cold, heavy oil introduces a number of operational issues. The most significant of these is “rod fall” and is caused by the highly viscous oil which limits the speed at which the sucker rod falls through the liquid. Other problems include rod string wear, deviated wells with doglegs, sand production, scale, leaking stuffing boxes, gas lock and speed changes.

The progressive cavity (PC) pump, with only two main parts (rotor and stator), is the simplest of the positive displacement pumps. The initial applications for PC pumps were in heavy oil areas of Canada because of the necessity to produce wells with high sand content to increase recovery while cold. Progressive cavity pumps continue to increase in number of installations worldwide with increased production capabilities. In highly viscous fluids, production becomes limited by the torque capabilities of the rods used to drive the pump. In addition, the PC pump is typically limited to operating temperatures less than 350 ºF due to temperature rating of the elastomer used in the stators. A new development on the horizon is the all metal progressive cavity pump. This pump may have the potential to be the pumping system of choice from cold, highly viscous wells up to and including high temperature, high water cut wells.

Electric submersible pumps (ESP) provide the production volume capabilities not typically attainable with sucker rod or PC pumps. Production rates in excess of 7000 bbls/d are achievable but the pumps suffer from other drawbacks such as high repair cost and inability to produce sand. In addition, for highly viscous oil, wells cannot be produced when water cuts are less than about 60 percent.

This presentation will strive to touch on the majority of the options available for production of heavy oil. As well, it is intended to summarize the typical operating envelopes for each system along with the operating issues that need to be addressed during the selection and design phase.