At high pressures the variation in gas properties between experimental data and different equations of state (EOS) increases. Furthermore, experimental data for hydrocarbon gas mixtures is scarce. Gas properties are used to predict the behavior of the compressor in the field. The power and speed requirements of the compressor will be based on the amount of polytropic head required to compress the gas according to the client’s specifications. In order to calculate this polytropic head requirement, the compressibility factor must be known. Compressibility factors vary widely for different gas compositions and different pressure ranges, and various equations of state are used to calculate the compressibility factor. The problem is that, for a given gas composition and pressure range, some of the equations of state will yield results that are far from the true compressibility factor values. It would be useful, then, to have a tool that would allow one to quickly determine which equation of state will be most accurate for the given operating conditions.

Uncertainty in the gas properties results in incorrect predictions of compressor performance. This project involves comparing experimental PVT data to seven different EOS. After determining which equations of state most accurately predicts the gas properties at high-pressure levels, a selection tool for determining the appropriate EOS was to be developed.

The objective was for the EOS selection tool to be a computer program, like MS Excel, that is simple enough for someone with little knowledge of PVT data and EOS to use. Dresser-Rand also requested that a comparative analysis of the data be performed and submitted, including graphical representations.

The team was well within the proposed $1000 budget spending a total of $220.50 of the allotted budget. Weekly staff meetings with the instructor were conducted every Tuesday during the progression of this project. Weekly teleconference meetings with the Dresser-Rand contact, Jorge Pacheco, were conducted every Thursday during the progression of this project.

To accomplish the objectives the team collected available PVT data, compiled a database of this data in MS Excel, and used Visual Basic programming to build a plug-in for MS Excel. We obtained access to a program, Design II from WinSim Inc., to which
Dresser-Rand currently has access. Design II performs calculations using the various equations of state. We manually produced graphs for the comparative analysis of a wide array of real gas compositions at various pressures and temperatures. An example of these graphs can be seen in the figures on the following page.

Unfortunately all of the customer’s needs were not met. However, a database with PVT data and EOS results with graphic analysis was built. The group ran into some complications with the programming of the actual selection tool so the accessibility of this data is limited to manual searches.

Figure 1: Sample of Graphical Output

![Graph of Z-Factor vs. Pressure](image1)

![Graph of Deviation](image2)