

Development of Computer Based Steady State and Dynamic Model for NGL Plants, Mesaieed State of Qatar



CLIENT

Qatar Petroleum Company (QP)

SUMMARY

Qatar Petroleum (QP) intended to develop a computer based steady state and dynamic model for NGL plants in Mesaieed.

The project outlines included:

1. Build steady state simulation model of Qatar Petroleum NGL 1/2/3/4 plants at Mesaieed using HYSYS.
2. Build dynamic simulation model for Qatar Petroleum NGL 1/2/3/4 plants at Mesaieed using HYSYS Dynamics.

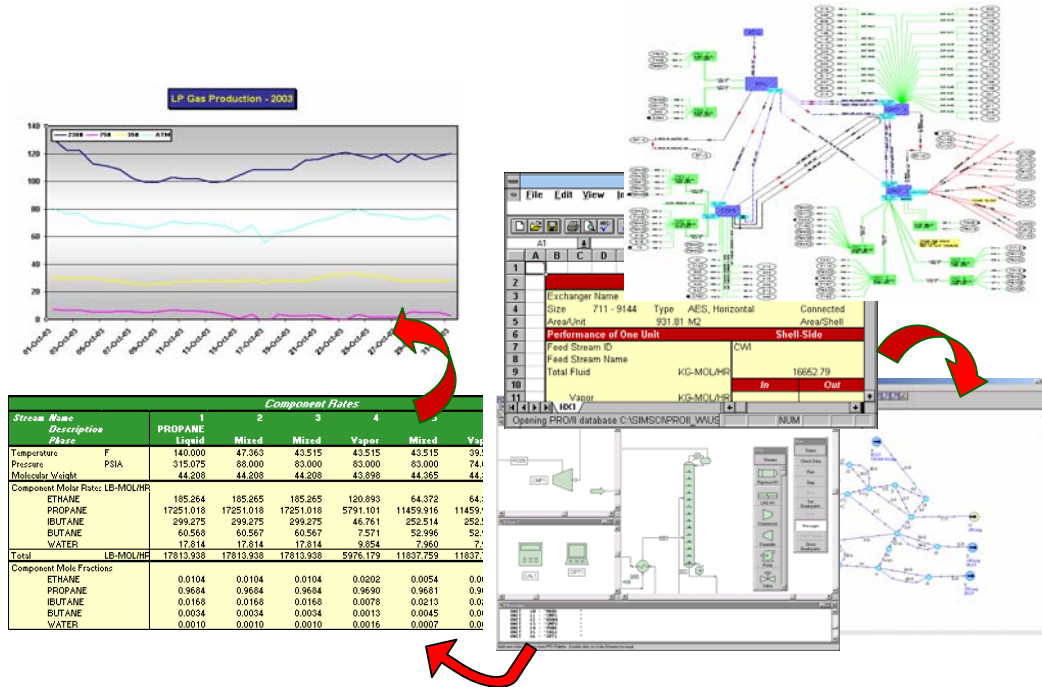
SCOPE

Steady State Model

The steady state model is capable of providing information to be used for the following:

- Tuning and troubleshooting of any equipment and the NGL Plant.
- Optimization to run the plant safely and economically.
- Planning and Scheduling.
- Plant performance monitoring.

- Process design and de-bottlenecking studies
- Detailed equipment design, rating, and costing
- Daily operations planning and LP vector updating and yield accounting.
- Performance and economics monitoring.



Dynamic Model

The dynamic model is capable of providing information to be used for the following:

- Process design and de-bottlenecking studies
- Investment analysis, and
- Process operations troubleshooting
- Advanced process control implementations (e.g., off-line step testing)
- Control System and safety related studies
- Compressor surge analysis,
- Relief systems,
- Emergency shut downs,
- Start up scenarios,
- Can be upgraded to an operator training system.

DESCRIPTION

Steady State Models

The steady state models are developed for each NGL plant using HYSYS. The steady state model development activity included the following activities:

- Acquire and validate Design Basis PFDs and P&IDs
- Acquire and validate Equipment data sheets
- Acquire and validate Mechanical data for all in-scope vessels, heat exchangers and columns.
- Create a HYSYS flow sheet that represents the Design Basis P&IDs, including control valves, block valves, pressure safety valves, drain lines, and fill lines.
- Create Streams, define their compositions, and select physical property methods using HYSYS.
- Populate the flow sheet process equipment, valves, and controllers with design data.
- Add to the HYSYS flow sheet, controllers, and instrumentation required for steady state operation of the plant.

The models represent the plant actual configuration and steady state performance. The models were tested on a single reconciled plant test data and validated against the plant design heat and material balance table.

The steady state standard deviation accuracy of the model results when, compared to steady state reference design data or operating data from the actual process after model tuning, model predictions were within 2% of the readings.

The models are able to handle different operating modes and scenarios as required by Qatar Petroleum. The user is able to change between different operating modes by changing the inputs to the model.

Dynamic Models

The dynamic models were developed for each NGL plant using HYSYS. The dynamic models starting point were the steady state models with the addition of control valves and the control system. The model reproduced dynamic and static responses with such accuracy that an experienced operator were not able to notice any significant difference between the model and process operation as perceived through the operator console man machine interface.

The performance criteria for accuracy of transient evolution's as represented by the model is that they possess the same dynamic characteristics, i.e. dead time, response, direction and order as the actual plant and that they remain within +/- 5% of reading for transients less than or equal to 1 minute and +/- 2.5% of reading for transient greater than 1 minute.

The dynamic models realistically modeled the flow through the units according to the pressure network of the model. Possible reversed flows were catered for in the model. Refinement or modification of the simulation models is possible through the standard capabilities of the HYSYS interface, and additional models may easily be included in the future through the capabilities of the standard HYSYS architecture.