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CASE STUDY: MPC BENEFITS NGL RECOVERY

A constrained model predictive control strategy was implemented on a natural gas liquids (NGL) recovery process at a gas plant in the Middle East. The project team headed by Sam Dhaliwal worked closely with plant personnel to understand the process and its constraints, and together design, build and implement a controller for one liquid recovery module. Despite the complexity of the project, significant financial benefits resulted and the project payback was approximately three months.

The gas production plant is dedicated to the production of sales gas, natural gas liquid and sulphur from sour gas. It has four identical liquid recovery modules, refrigeration and demethanization systems. The process dynamics are complex and there is strong interaction between major control variables. An initial advanced process control (APC) feasibility study coupled with actual plant tests highlighted areas where MultiVariable Control (MVC) technology could bring significant benefits by increasing throughput and NGL recovery.

The project focussed on designing and implementing an MVC application on one liquid recovery module. From the beginning, the project team headed by Sam Dhaliwal brought together key internal personnel including plant process and control engineers, experienced operators and control engineers from the corporate and technical support departments. The first step for the MVC project team was to fully understand the process and operation objectives, the process economics and the process constraints, and to critically review the existing DCS regulatory control loops, instrumentation and current operators' practices and constraints. A list of all Manipulated, Feedforward and Controlled variables was created as a result of the initial phase of the project.

The next step was to incorporate these variables into an accurate dynamic model of the process. By capturing dynamic models of the process, future behaviour can be predicted and hence corrective action can be taken by implementing moves on Manipulated Variables.. The project team carried out a two-week plant response test using SmartStep software, and the preliminary model iteratively improved through modelling, analysis and testing until it represented the plant's behaviour accurately. The MVC system was built using DMCplus, Aspentech's commercial APC software.

Once the plant model was developed, the controller could be built. Off-line simulations validated the controller and identified the initial tuning parameters. The controller was then implemented on the plant and run parallel to existing systems in 'prediction-only' mode, to ensure that the model accurately reflected the plant.After a period of testing, the control system was then implemented on the plant and started manipulating plant variables. Operators were fully trained and comfortable using the new system and acceptance was high. Moreover, having been fully involved with the project from the beginning, the plant had immediate and on-going in-house support and maintenance.

The implementation was highly successful and paid back within three months. Throughput to the liquid recovery module and NGL recovery were both increased by approximately 5% and 3-4% respectively, propane losses were minimised and the variability of C_1/C_2 in the NGL product reduced. In addition the successful technology transfer has enabled the plant to implement two additional controllers using its own

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