ABB's Optimize[IT] Enhanced Oil Production Suite

a report by
ABB AS

ABB's Optimize[IT] enhanced oil production suite is a family of systems, solutions and services targeted at increasing oil and gas production. Compared with other process industries, the upstream oil and gas industry has historically been considered as a low-tech industry with regards to automation level. However, appropriate utilisation of modern automation technologies improves oil and gas plant regularity and throughput, and provides valuable means for achieving increased oil recovery. Due to the positive effects of automation, the up-stream industry currently faces a shift in automation level. Utilisation of basic automation is now becoming the industry standard instead of the exception.

For several years, ABB has developed advanced control and optimisation solutions for the upstream oil and gas industry. It has taken a fundamental approach to the operational challenges of the oil and gas industry and developed industry-specific products and solutions for well production optimisation, operational flow assurance, and oil and gas plant optimisation. Amongst the various flow assurance issues, special emphasis has been given to active slug control. The solutions are targeting maximum plant regularity and throughput while providing minimum environmental impact.

Workflow

Advanced process control and optimisation of upstream oil and gas systems are inter-disciplinary activities. To achieve true optimum for the optimisation problem, and hence have the objectives in place for advanced process control, input from reservoir, production, process and automation engineers as well as commercial issues must be taken into consideration. *Figure 2* illustrates some of the key challenges. To achieve optimal production, the slow dynamics of the reservoir must be optimised and controlled simultaneously with the shorter dynamics of the wells and production facilities. The main challenges related to advanced control and optimisation of upstream oil and gas plants are:

- maximising reservoir recovery, while utilising all available processing capacity;
- securing continuous and stable flow from the wells to the processing facilities (flow assurance);
- minimising downtime of wells and production facilities (maximum availability);
- meeting the contractual requirements for the products (oil, condensate and gas); and
- predicting future changes in well behaviour (reservoir – of well problems, reduced production, slugging, etc.).

Upstream Applications and Services

The Optimize[IT] enhanced oil production suite is a family of systems, products and services aiming at increasing oil and gas production, and is part of ABB's industrial information technology (IT) platform. These systems are standardised and modular and capable of full integration with any control system. Optimize[IT] applications can be installed as stand-alone solutions to specific problems, or as total asset management solutions. The Optimize[IT] enhanced oil production offering includes the following.

Audit and Tuning

Process and control system tuning assists plant owners in identifying possible opportunities that lead to increased uptime, increased throughput and reduced emissions. Control system tuning focuses on stability, performance, robustness and dynamic interaction between process units.

Automatic Well Test (Well Test by Exception)

Pattern recognition techniques will automatically calculate skin and permeability in wells. Well test by exception provides valuable input for reservoir optimisation.

Well Monitoring System

The well monitoring system is a model-based system for estimating the flowrates of oil, gas and

Figure 1

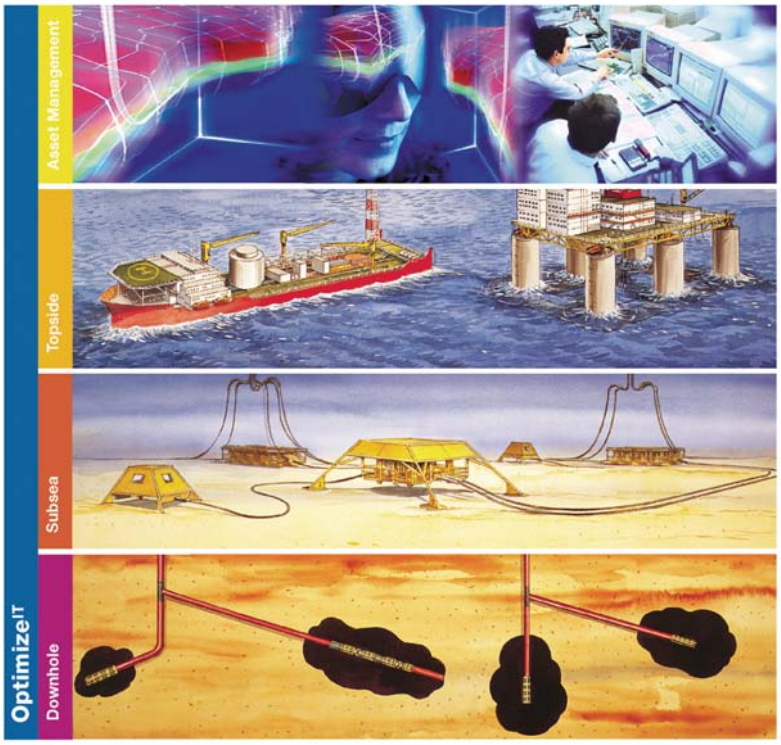
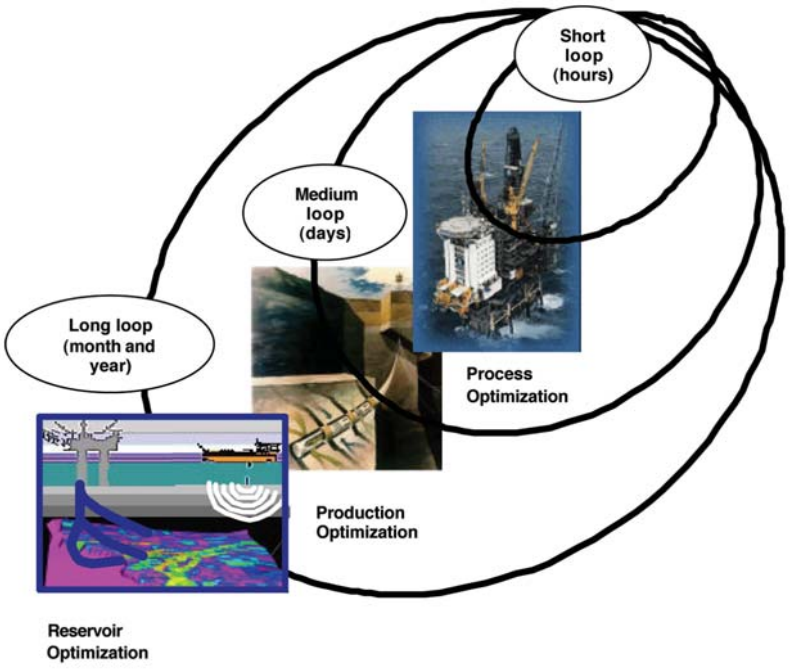


Figure 2



water from all the individual wells in an oilfield. The realtime estimation is based on data from available sensors in the wells and flowlines. The well monitoring system may be used as a software multiphase flow meter, as a reliability tool and as a production allocation system.

Gas-lift Optimisation

Ensures optimal distribution of lift-gas between gas-lifted wells, (often maximum oil production with minimum usage of lift gas).

Active Flowline Control

Active flowline control controls and stabilises multiphase flow in gathering systems, risers and flow lines. It is currently the only active control solution in the market for mitigation of terrain-induced slugs. Active flowline control prevents flow and pressure surges and smoothes the flow without increasing line backpressure.

Active Well Control

Active well control stabilises and optimises gas lift and naturally flowing wells. Active well control prevents flow and pressure surges while maintaining minimal backpressure and maximum production. For gas lift wells it maintains stable production at the optimum lift gas rate.

Constraint Monitoring Tool

Usually, optimal operation is defined by a set of constraints in the wells and production facilities. The constraint monitoring tool monitors closeness to all constraints, and suggests corrective actions needed to move current operation closer to true optimum.

Advanced Control and Optimisation Solution

The objective of advanced control projects is to improve the performance of product quality control whilst adhering to operating constraints. This is typically done with two technologies; model predictive control to drive the process closer to operating targets, and inferential measurement to increase the frequency of product quality feedback information. ABB provides this capability in two packages.

Optimize^{IT} Predict and Control

Optimize^{IT} predict and control (P&C) is a multivariable, model predictive control software technology package. P&C is typically implemented at the supervisory level to manipulate setpoints of multiple control loops in order to drive multiple process output variables to their targets and enforce operating constraints.

Optimize^{IT} Inferential Modelling Platform

The Optimize^{IT} inferential modelling platform (IMP) is a software package for offline development and online implementation of empirical models for advanced process control applications. The Optimize^{IT} IMP allows development of empirical models featuring different modelling techniques,

combining neural networks, statistical regressions, principle component analysis (PCA) and multivariate statistical process control (MvSPC) into a single package.

Remote Monitoring

Upstream production facilities are, by nature, often remotely located. ABB EOP has developed a secure concept for remote connection to a customer plant. The concept includes facilities, connectivity and work procedures.

The remote room is being used within project execution during activities such as data gathering/ monitoring and during service work on the install base.

Integration of Applications

All upstream applications and solutions are industrial IT-enabled and, hence, easy to integrate. Usually, the applications are delivered with process portal A as the engineering workplace.

Process portal A is a full-featured operator interface. It combines state-of-the-art operator functions like process graphics and navigation, trending, and alarms and events, with the flexibility of Windows 2000. For the upstream advanced control and optimisation software, process portal has been configured with a system performance monitoring tool (SPMT). The SPMT reports the performance of both the wells and the production facilities, as well as the performance of the individual advanced monitoring, control and optimisation applications.

The above technologies put ABB in a unique position with regards to optimisation of upstream oil and gas plants. ■

Figure 3

Figure 4