Integrated Flow Assurance Solution
Ormen Lange - a case study

Client: StatoilHydro (Project), Shell (Operator)
Location: 120 km off the Møre coast in central Norway
Sea depth: 800 – 1100 meters
Gas production capacity: 70 million Sm3 per day, exported to the UK through a 120 kilometer long pipeline
Condensate production capacity: 6000 to 8500 m3 per day
Ormen Lange Integrated Flow Assurance Solution

Only the best and most reliable of equipment and solutions are good enough when it comes to meeting the challenges posed by the harsh environment of the Ormen Lange field. Implementing the most advanced real-time flow assurance solution to date was therefore entrusted with FMC Technologies and their highly skilled partners.

Ormen Lange FAS solution

Sub-zero temperatures at the seabed, a wild subsea "mountain" range and long transport lines all contribute to operational risks and challenges:

- Hydrates may form, thus interrupting flow of produced gas
- Liquid surges (slugs) may occur
- Formation water may break through
- Production system may develop leaks
- Production must be balanced for optimal reservoir sweep
- Production rate and gas export requirement must be balanced
- Accurate Flow Metering is needed to confidently produce large volumes of gas
- Reliable monitoring mechanisms for safe and efficient operations of the field and the subsea production system

Ormen Lange custom-made FAS

The Ormen Lange FAS is a custom-made Flow Assurance System that combines extensive Flow Assurance and Flow Metering experience with best practices and standard software applications.

The core of the FAS is the FlowManager™ Metering application with its very fast model. This provides automatically validated metering information to the rest of the FAS in absolute real time. The operator can therefore make confident decisions based on results and advice provided by the FAS.

Ormen Lange FAS operation

The FAS receives data from both subsea and surface instrumentation through the Control System. Data from pressure and temperature sensors, multiphase flow meters, chokes, rates, slug levels etc. is reconciled in a tuned model.

Through a comparison between modeled data and actual data, anomalies can be detected in real-time at any point in the production system, with an immediate visual notification. The different FAS components monitor and simulate different production system parameters. Should a sensor drift or malfunction, this will be detected. Should there be a danger of hydrate formation, this will be detected and notified ahead of hydrates actually forming. Similarly for e.g. formation water breakthrough and other events that may diminish the performance of the subsea production system.

Confidence in FAS

The accuracy of the virtual metering has proven impressive. So has the overall robustness of the FAS models. Should a physical flowmeter or any other sensor fail, production can be confidently maintained at the high rates required to meet the delivery obligations.

Being able to sustain a high production even in the event of a flowmeter failure, means that the planned revenue-stream can be maintained at all times.
FAS functionalities

Advanced Flow Metering

- High accuracy backup for wet gas meters
- Ensure high-quality metering information

Production Choke Control

- Achieve optimal set-points for all chokes in order to optimize production while minimizing the number of choke adjustments
- Accurately control surges and slugging
- Manual or automatic control of choke advice

Hydrate Management

- Detect hydrate formation potential prior to it actually happening - with enough warning to take corrective action
- Avoid costly, time-consuming and potentially unsafe activities to remove hydrate plugs once they have formed

MEG Injection Management

- Ensure sufficient MEG is injected to inhibit the entire flow path

Fast Ramp-up Control

- Instant access to maximum safe ramp-up rate and period, i.e. production ramp-up without flooding the slug catcher

Formation Water Monitoring

- Get early warning of formation water break-through
- Provide information for optimal reservoir management

Pipeline Management

- Detect leaks, blockages or other potentially harmful dynamic behavior in the production system
- Effectively model and manage fluid behavior, such as liquid hold-up, liquid distribution and liquid surge dynamics, through the entire production system
- Manage pigging operations through pig tracking