



FEESA Consultancy Services

Founded in 2001, FEESA is a management and employee owned oil & gas engineering consultancy specialising in conceptual engineering studies, integrated production modelling and flow assurance (IPM and FA). We are now a company of about 25 people with a consultancy team of 14, a dedicated software team and offices in Farnborough, UK and Perth, Australia.

FEESA's consultants are recognised as amongst the best in the world. They are supporting operators of oil & gas developments in many economically sensitive locations, including the UKCS, offshore Angola and the Australian NW Shelf.

FEESA's consultants are experienced users of the major transient and steady state flow modelling software, but have the advantage of Maximus, the company's proprietary software. Maximus is recognised across the industry as a modern and user-friendly software suite for integrated production, pipeline and flow assurance modelling. Maximus enables rapid development of comprehensive and accurate models of production network and pipeline scenarios through life of field (LoF), thus facilitating confident decision making during the design phases of oil & gas field developments.

The FEESA Advantage

FEESA consultants work with an operator or engineering company from the earliest stages of project feasibility mapping, through all project phases. Early feasibility mapping usually begins before there is a mature reservoir model.

Our consultants will work with operator personnel to build accurate and user friendly LoF model scenarios using Maximus, with output either in the form of engineering or economic performance criteria, possibly linked to the terms of production sharing or gas sales contracts. As conceptual engineering develops, the Maximus reservoir module can be substituted by links from market leading reservoir simulators. In the latter stages of a project the Maximus model can be used by the operator as a management tool, which enables integration of the different project disciplines, thus improving workflow.

Working with the FEESA consultancy team gives many advantages; including:

- Pioneers of truly integrated, large network, LoF flow assurance
- Experts in the use of Maximus with immediate access to the software development team for custom modification
- A large, FA /IPM focused team of highly qualified staff (many with PhDs) with broad FA / IPM experience
- Ability to assemble lean project teams, with a quick turnaround of work, tailored to clients' needs
- Perform studies that are low cost but give high value to the client and result in concise, easy to understand reports
- Flexible in the types of study with the ability to handle non-standard problems
- All team members are staff, with extremely low staff turnover
- Potential for secondment of experienced staff into client teams

FEESA Skills

FEESA's skills cover the full-range of flow assurance requirements, including:

Steady State Thermal Hydraulic Modelling

Steady state modelling of multiphase well, pipeline and riser systems using advanced engineering tools such as Maximus software. FEESA's consultants are able to develop comprehensive and accurate models of converging, diverging and/or looped production, injection and pipeline systems including the selection of appropriate inflow performance relationships for modelling reservoir flows.

Deliverability Modelling

Using Maximus as an IPM tool, FEESA has performed numerous studies for major clients to investigate deliverability and production. Building a fully integrated model from the reservoir to the facilities, we have looked at the effects of: tubing and pipeline size, multiphase boosting, gas-lift injection, subsea processing and various novel technologies (such as hydrate slurry flow) on the production rates achievable from a given configuration. By investigating a large number of system permutations, clients have been able to use the production profiles generated by Maximus to perform comparative economic selections, thus identifying the optimal configuration.

Transient Multiphase Modelling

With the increasing flow assurance challenges encountered with deepwater developments and long-range subsea tiebacks, transient multiphase flow simulation has become a standard technique for investigating system behaviour and operability. FEESA's consultants have developed considerable experience in this area with Schlumberger's OLGA, Kongsberg's Ledaflow, pseudo-transient methods (avoiding the high software overheads) and bespoke methods, where appropriate. This experience has been

developed via a number of projects including some high profile deepwater developments.

Flow Assurance Operability Studies

The key to the successful use of steady state and transient modelling is interpreting the results to produce a comprehensive operating strategy. FEESA has gained considerable experience in the evaluation of flow assurance operability of dozens of complex production networks. Results from thousands of simulations can be compiled to develop operating guidelines that are comprehensive enough to be peer reviewed, yet still intelligible by other disciplines. Issues typically addressed are terrain induced slugging, hydrate, wax and asphaltene prevention / remediation, thermal control, production boosting, erosion / corrosion and complex rheology, amongst others.

Specialist Fluid Flow Studies

FEESA's consultants have a detailed understanding of the fundamentals of fluid flow and heat transfer which has been put to good effect on a number of specialist fluid flow studies. These have included the analysis of sand transportation in multiphase flows, the evaluation of erosion effects due to particulate transfer, the modelling of non-Newtonian flows in gelled oil systems, hydrate slurry transportation and the investigation of jet-pump (eductor) hydraulics.

Expert Witness & Forensic

FEESA have valuable experience of performing both consulting and testifying expert witness work on high profile litigation. The consulting expert witness experience includes forensic analysis. FEESA provided a key testifying expert witness, on behalf of BP, for the Deepwater Horizon litigation, arguably the largest environmental case in legal history at that time (trial documents can be found at www.mdl2179trialdocs.com/).

Previous Projects

BP Group

- Ithaca, Stella & Harrier tiebacks to Lomond
- Jackdaw development
- Confidential Nationwide gas transmission network study
- Confidential subsea processing study

BP Angola

- Block 18 Platina, Chumbo, Cesio tieback to Greater Plutonio
- Block 15 concept evaluation of future tiebacks to Kizomba A & B
- Block 31 PSVM, Leda Terra, South East (Palas Astraea, Juno + futures), Mid and West (Titania, Leda, Miranda + futures)

BP America

- Testifying and consulting expert witness work on the Deepwater Horizon litigation

BP Azerbaijan

- Shah Deniz phase II
- ACG redevelopment
- BP Egypt
- West Nile Delta

BP Central Technology Group

- Production profile forecasting of various cold flow (hydrate slurry) tieback scenarios

BP Indonesia

- Tangguh development

BP Oman

- Khazzan development

BP UK

- Greater Clair

CalEnergy

- Anglia NW tieback, UKCS

CB&I

- WREP de-oiling leak modelling

Centrica

- Mallard
- Fogelburg
- Trinidad and Tobago Blocks 1a & 1b
- East Irish Sea carbon dioxide Injection Study
- Annabel infill

Chevron

- Greater Gorgon expansion project forecasting tool

ConocoPhillips

- Enochdhu tieback to Callanish
- Confidential conceptual design of a large offshore gas development (SPE 116593)
- Malakia development (Malaysia)

ENI/KDPC

- Kashagan development, Kazakhstan

GdF Britain

- Cygnus phase I
- Anglia NW tieback, UKCS

Heliswirl

- Production profile forecasting of a novel helical riser concept

Hess

- Equus development
- Chestnut development, UKCS

Maersk

- Dumbarton tieback

Masons

- Expert witness support on pipeline design litigation

OMV

- Rosebank

PetroCanada

- Guillemot west extension, UKCS

Petroceltic

- Algeria Isarene development

Premier Oil

- Sea Lion

Saipem

- Support to subsea design team, Fano

Statoil

- Snohvit expansion project

TMF

- Multiphase R&D

Tullow

- TEN
- Jubilee

Woodside

- Greater Western Flank tieback to Goodwin & Rankin
- Browse project
- Chinguetti development, Mauritania
- Torosa development (future tieback to Browse)
- Laverda deepwater heavy oil and gas
- Subsea processing study of Xena-Pluto expansion



FEESA Consultancy Services

Key Team of Consultants

Martin Watson (Director)

Martin has 18 years engineering experience and holds a PhD in multiphase flow from Imperial College, London. He has worked on a number of field developments as a flow assurance engineer for Granherne, before co-founding FEESA. Martin specialises in IPM modelling, transient multiphase flow analysis and the development of flow assurance operating strategies and guidelines. Martin has developed significant experience in deepwater gas-oil developments, in particular BP's deepwater Angola programme and has also worked on several large gas gathering networks.

Neil Hawkes (Director)

Neil has 20 years engineering experience and holds a PhD multiphase flow from Imperial College, London. He subsequently joined Baker Jardine & Associates where he was responsible for the development of a novel LoF simulation tool called Pipesim-FPT, now marketed by Schlumberger. While at Baker Jardine, he also performed a number of consultancy studies for clients such as PDVSA, PEMEX, BP and Norsk Hydro. Since co-founding FEESA, Neil has been responsible for the development of the Maximus integrated production modelling tool. He has used his in-depth knowledge of IPM in detailed modelling studies for BP Angola and Woodside Australia.

Adrian Johnson (Consultancy Manager)

Adrian has 29 years engineering experience, holds a PhD in complex fluid mechanics from the University of Surrey and is a chartered mechanical engineer. He worked for 10 years for BP in R&D, pipeline engineering / flow assurance and was the company specialist in the use of DRA. Subsequent to BP, Adrian became a freelance consultant in pipeline hydraulics and flow assurance for 11 years, before joining FEESA as consultancy manager at the beginning of 2010. Adrian has experience of numerous oil and gas production studies for companies such as BP, Centrica, ConocoPhillips, Petroceltic, Tullow, etc., he worked closely on the flow assurance on BP's deepwater Angola programme for 2 years and was a testifying expert in the Deepwater Horizon litigation in 2013. He manages a growing team of flow assurance specialists based in Farnborough.

Justin Alexander (Deputy Consultancy Manager)

Justin has 18 years engineering experience, holds an MEng in chemical engineering from Imperial College, London and is a chartered chemical engineer. He worked for 17 years for UK-based engineering contractors, managing process design teams on conceptual studies and FEED projects for major oil and gas projects for clients including ExxonMobil, Chevron, Total, Saudi Aramco and BP. Justin joined FEESA in 2012 as deputy consultancy manager, to support Adrian's management of FEESA's fast growing team of flow assurance consultants, and takes the lead role on a variety of consultancy projects including flow assurance studies, complex production network modelling, forecasting and CO₂ injection network modelling.