COURSE OVERVIEW DE0283
Performance Analysis, Prediction and Optimization Using Nodal Analysis

Course Title
Performance Analysis, Prediction and Optimization Using Nodal Analysis

Course Date/Venue
Session 1: May 26-30, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: November 16-20, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
DE0283

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

Any production well is drilled and completed to move the oil or gas from its original location in the reservoir to the stock tank or sales line. Movement or transport of these fluids requires energy to overcome friction losses in the system and to lift the products to the surface. The fluids must travel through the reservoir and the piping system and ultimately flow into a separator for gas-liquid separation.

The production system can be relatively simple or can include many components in which energy or pressure losses occur. The final design of a production system cannot be separated into reservoir performance and piping system performance and handled independently. The amount of oil and gas flowing into the well from the reservoir depends on the pressure drop in the piping system, and the pressure drop in the piping system depends on the amount of fluid flowing through it. Therefore, the entire production system must be analyzed as a unit.

Nodal analysis views the total producing system as a group of components potentially encompassing reservoir rock/irregularities, completions (gravel pack, open/closed perforations, open hole), vertical flow strings, restrictions, multi-lateral branches, horizontal/hilly terrain flow lines/risers, integrated gathering networks, compressors, pump stations, metering locations, and market/system rate/pressure constraints. An improper design of any one component, or a mismatch of components, adversely affects the performance of the entire system. The chief function of a system-wide analysis is to increase well rates. It identifies bottlenecks and serves as a framework for the design of efficient field wide flow systems, including wells, artificial lift, gathering lines and manifolds.

The nodal systems analysis approach is a very flexible method that can be used to improve the performance of many well systems. To apply the systems analysis procedure to a well, it is necessary to be able to calculate the pressure drop that will occur in all the system components. These pressure drops depend not only on flow rate, but on the size and other characteristics of the components. The nodal analysis procedure consists of selecting a division point or node in the well and dividing the system at this point to optimize performance in the most economical manner. Although the entire production system is analyzed as a total unit, interacting components, electrical circuits, complex pipeline networks, and centrifugal pumping are evaluated individually using this method. Locations of excessive flow resistance or pressure drop in any part of the network are identified.

Together with reservoir simulation and analytical tools, Nodal analysis is used in planning new field development. Initially, this technology was applied using pressure traverse curves and simple PI models. Now state-of-the-art software programs have enabled a well-trained engineer to concentrate on matching field data, interpreting results, and understanding a system's interdependencies.

This course is designed to provide participants with a detailed and up-to-date overview of performance analysis, prediction and optimization using NODAL analysis. It covers the nodal analysis and the production system analysis; the inflow performance, reservoir performance and well performance equations; the prediction of present and future time IPRs for oil wells as the present time IPRs for gas wells; the well completion effects, inflow performance summary and completion analysis; the modeling basics, flow patterns in gravel packs, pressure drop in perforations, gravel packs and wellbore; the optimal perforation density, tubing performance, flow dynamics, logging in horizontal wells, slugging and pressure changes in all completion types; the unloading techniques, flow in pipes, restrictions, basic equation and concepts, fluid property calculations and well flow correlations; and the pressure drop through restrictions, erosional velocity and bottlenecks in a gathering network.

During this interactive course, participants will learn the line loops, jumpers, gathering systems and total system analysis; the tubing size selection, flowline size effect and stimulation effect; the system analysis for wells with restrictions and evaluating completion effects; the field forecasts, economic optimization, evaluations of options and nodal analysis for injection wells; the effect of depletion, relating performance to time and analyzing multiwell systems; the artificial lift design, continuous flow gas lift, submersible pump selection (ESP), sucker rod or beam pumping and hydraulic pumping; and the liquid in gas streams, dry gas well, loaded wells and temperatures prediction.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on Nodal Analysis (Petroleum Experts IPM)
- Apply nodal analysis concepts viewing the total producing system as a whole from the reservoir rock through the completion, well bore and gathering system, to the market while honoring system rate/pressure constraints
- Avoid improper design where any one component, or a mismatch of components, adversely affects the performance of the entire system
- Perform a system-wide analysis to increase well rates by identifying bottlenecks and design an efficient field-wide flow system, including wells, artificial lift, gathering lines and manifolds
- Use nodal analysis, together with reservoir simulation and analytical tools for planning new field development
- Discuss nodal analysis and production system analysis
- Explain inflow performance, reservoir performance and well performance equations
- Predict present and future time IPRs for oil wells and predict present time IPRs for gas wells
- Recognize well completion effects, inflow performance summary and completion analysis
- Discuss modeling basics, flow patterns in gravel packs, pressure drop in perforations, gravel packs and wellbore
- Describe optimal perforation density, tubing performance, flow dynamics, logging in horizontal wells, slugging and pressure changes in all completion types and friction drop in horizontal wells
- Illustrate unloading, flow in pipes, restrictions, basic equation and concepts, fluid property calculations and well flow correlations
- Recognize pressure drop through restrictions, erosional velocity and bottlenecks in a gathering network
- Identify line loops, jumpers, gathering systems and total system analysis
- Select tubing size and discuss flowline size effect and stimulation effect
- Carryout system analysis for wells with restrictions and evaluate completion effects

- Employ field forecasting, economic optimization, evaluations of options and nodal analysis for injection wells
- Discuss the effect of depletion, relate performance to time and analyze multiwell systems
- Illustrate artificial lift design, continuous flow gas lift, submersible pump selection (ESP), sucker rod or beam pumping and hydraulic pumping
- Identify liquid in gas streams, define dry gas well, discuss loaded wells and predict temperatures

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of nodal analysis (Petroleum Experts IPM) for production engineers and production, operations as well as senior technicians and field supervisors with an engineering background.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

US$ 8,000 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)
Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations
Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Dr. Chris Kapetan, PhD, MSc, is a **Senior Petroleum Engineer** with over **30 years** of international experience within the **onshore** and **offshore oil** & **gas** industry. His wide experience covers **Decision Analytic Modelling Methods** for **Economic Evaluation**, **Probabilistic Risk Analysis** (**Monte Carlo Simulator**) **Risk Analysis Foundations**, **Global Oil Demand**, Crude Oil Market, Global Oil Reserves, Oil Supply & Demand, Governmental Legislation, Contractual Agreements, **Financial** Modeling, **Oil Contracts**, **Project Risk Analysis**, **Feasibility Analysis** Techniques, **Capital Operational Costs**, Oil & Gas Exploration Methods, **Reservoir** Evaluation, **Extraction of Oil & Gas**, **Crude** Oil Types & Specifications, Sulphur, Sour Natural Gas, **Natural Gas Sweeting**, **Petroleum Production**, Field Layout, **Production** Techniques & Control, **Surface Production** Operations, **Oil Processing**, Oil Transportation-Methods, **Flowmetering & Custody Transfer** and **Oil Refinery**. Further, he is also well-versed in Enhanced Oil Recovery (**EOR**), Electrical Submersible Pumps (**ESP**), **Oil Industries Orientation**, **Geophysics**, Cased Hole **Formation Evaluation**, Cased Hole **Applications**, Cased Hole **Logs**, Production **Operations**, Production **Management**, Perforating **Methods & Design**, Perforating **Operations**, **Fishing** Operations, **Well & Reservoir** Testing, **Reservoir Stimulation**, **Hydraulic Fracturing**, **Carbonate** Acidizing, **Sandstone** Acidizing, **Drilling Fluids Technology**, Drilling **Operations**, **Directional** Drilling, **Artificial Lift**, **Gas Lift Design**, **Gas Lift Operations**, **Petroleum Business**, **Petroleum Economics**, **Field Development Planning**, **Gas Lift Valve** Changing & Installation, **Well Completion** Design & Operation, Well **Surveillance**, Well **Testing**, Well **Stimulation** & **Control** and **Workover Planning**, **Completions** & **Workover**, **Rig Sizing**, **Hole Cleaning** & **Logging**, **Well Completion**, **Servicing** and **Work-Over Operations**, Practical **Reservoir Engineering**, **X-mas Tree & Wellhead** Operations, Maintenance & Testing, **Advanced Petrophysics/Interpretation** of **Well Composite**, **Construction Integrity** & **Completion**, **Coiled Tubing Technology**, **Corrosion Control**, **Slickline**, **Wireline & Coil Tubing**, **Pipeline Pigging**, **Corrosion Monitoring**, **Cathodic Protection** as well as Root Cause Analysis (**RCA**), Root Cause Failure Analysis (**RCFA**), **Gas Conditioning & Process Technology**, **Production Safety** and **Delusion of Asphalt**. Currently, he is the **Operations Consultant** & the **Technical Advisor** at **GEOTECH** and an independent **Drilling Operations Consultant** of various engineering services providers to the international clients as he offers his expertise in many areas of the **drilling & petroleum discipline** and is well **recognized & respected** for his process and procedural expertise as well as ongoing participation, interest and experience in continuing to promote technology to producers around the world.

Throughout his long career life, Dr. Chris has worked for many international companies and has spent several years **managing** technically **complex wellbore interventions** in both **drilling** & **servicing**. He is a **well-regarded** for his **process** and **procedural expertise**. Further, he was the **Operations Manager** at **ETP Crude Oil Pipeline Services** where he was fully responsible for optimum operations of crude oil pipeline, **workover** and **directional drilling**, **drilling rigs** and equipment, drilling of various geothermal deep wells and **exploration wells**. Dr. Chris was the **Drilling** & **Workover Manager** & **Superintendent** for **Kavala Oil** wherein he was responsible for supervision of **drilling operations** and **offshore exploration**, quality control of performance of **rigs**, **coiled tubing**, crude oil transportation via pipeline and abandonment of **well** as per the API requirements. He had occupied various key positions as the **Drilling Operations Consultant**, **Site Manager**, **Branch Manager**, **Senior Drilling** & **Workover Manager** & **Engineer** and **Drilling** & **Workover Engineer**, **Operations Consultant**, **Technical Advisor** in several petroleum companies responsible mainly on an **offshore** sour oil field (under water flood and gas lift) and a gas field. Further, Dr. Chris has been a **Professor** of the **Oil Technology College**.

Dr. Chris has **PhD** in **Reservoir Engineering** and a **Master** degree in **Drilling & Production Engineering** from the **Petrol-Gaze Din Ploiesti University**. Further, he is a **Certified Surfaced BOP Stack Supervisor** of **IWCF**, a **Certified Instructor/Trainer**, a **Certified Trainer/Assessor/Internal Verifier** by the **Institute of Leadership & Management** (**ILM**) and has conducted **numerous short courses**, **seminars** and **workshops** and has published several technical books on **Production Logging**, **Safety Drilling Rigs** and **Oil Reservoir**.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0800 – 0830	*Registration & Coffee*
0830 – 0845	*Welcome & Introduction*
0845 – 0900	***PRE-TEST***
0900 – 0915	***Nodal Analysis Overview***
0915 - 0930	***Production System Analysis***
0930 – 0945	*Break*
0945 – 1015	***Inflow Performance: Basics, Well-test Pros & Cons, Best Models for all Well Types, IPR Curves***
1015 – 1100	***Reservoir Performance***
1100 – 1200	***Well Performance Equations***
1200 – 1300	*Lunch*
1300 – 1330	***Predicting Present Time IPRs for Oil Wells***
1330 - 1400	***Predicting Future IPRs for Oil Wells***
1400 – 1415	*Break*
1415– 1430	***Predicting Present Time IPRs for Gas Wells***
1430 – 1445	***Well Completion Effects***
1445 – 1515	***Inflow Performance Summary***
1515 – 1550	***Completion Analysis***
1550 – 1600	***Recap***
1600	*End of Day One*

Day 2

0800 – 0830	***Modeling Basics***
0830 - 0900	***Flow Patterns in Gravel Packs***
0900 - 0930	***Pressure Drop in Perforations***
0930 – 0945	*Break*
0945 – 1015	***Gravel Packs & Wellbore***
1015 – 1100	***Optimal Perforation Density***
1100 – 1200	***Tubing Performance***
1200 – 1300	*Lunch*
1300 – 1330	***Videos of Flow Patterns***
1330 - 1400	***Flow Dynamics***
1400 – 1415	*Break*
1415– 1430	***Logging in Horizontal Wells***
1430 – 1500	***Slugging & Pressure Changes in All Completion Types***
1500 – 1550	***Friction Drop in Horizontal Wells***
1550 – 1600	***Recap***
1600	*End of Day Two*

Day 3

0800 – 0830	***Unloading Techniques & Examples***
0830 - 0900	***Flow in Pipes & Restrictions***
0900 - 0930	***Basic Equations & Concepts***
0930 – 0945	*Break*

0945 – 1015	**Fluid Property Calculations**
1015 – 1100	**Well Flow Correlations**
1100 – 1200	**Pressure Drop Through Restrictions**
1200 – 1300	Lunch
1300 – 1330	**Erosional Velocity**
1330 - 1400	**Bottlenecks in a Gathering Network**
1400 – 1415	Break
1415– 1430	**Line Loops & Jumpers**
1430 – 1500	**Gathering Systems**
1500 – 1550	**Total System Analysis**
1550 – 1600	**Recap**
1600	End of Day Three

Day 4

0800 – 0830	**Tubing Size Selection**
0830 - 0900	**Flowline Size Effect**
0900 - 0930	**Effect of Stimulation**
0930 – 0945	Break
0945 – 1015	**Systems Analysis for Wells with Restrictions**
1015 – 1100	**Evaluating Completion Effects**
1100 – 1200	**Field Forecasts**
1200 – 1300	Lunch
1300 – 1330	**Economic Optimization**
1330 - 1400	**Evaluation of Options**
1400 – 1415	Break
1415– 1430	**Nodal Analysis of Injection Wells**
1430 – 1500	**Effect of Depletion**
1500 – 1550	**Relating Performance to Time**
1550 – 1600	**Recap**
1600	End of Day Four

Day 5

0800 – 0830	**Analyzing Multiwell Systems**
0830 - 0900	**Artificial Lift Design**
0900 - 0930	**Continuous Flow Gas Lift**
0930 – 0945	Break
0945 – 1015	**Submersible Pump Selection (ESP)**
1015 – 1100	**Sucker Rod or Beam Pumping**
1100 – 1200	**Hydraulic Pumping**
1200 – 1300	Lunch
1300 – 1330	**Liquid in Gas Streams**
1330 - 1400	**What is a Dry Gas Well?**
1400 – 1415	Break
1415– 1445	**Loaded Wells**
1445 – 1515	**Predicting Temperatures**
1515 – 1530	**Course Conclusion**
1530 – 1545	**POST-TEST**
1545 – 1600	Presentation of Course Certificates
1600	End of Course

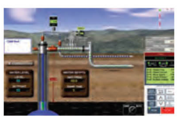
<u>Simulators (Hands-on Practical Sessions)</u>

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using one of our state-of-the-art "PROSPER" software.

PROSPER

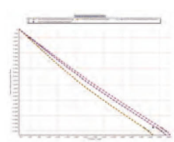
MULTIPHASE WELL AND PIPELINE NODAL ANALYSIS

WELL AND PIPELINE MODELS



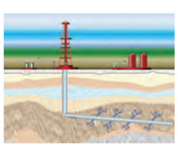
PROSPER was commercialised in the early 90's and has been the subject of ongoing research and development for over two decades. Each year, new models and functionalities are added to the already extensive list of options in the program. There are over three million combinations of options that can be used to describe the vast majority of physical phenomena happening in wells and pipelines. In spite of the large number of situations that can be modelled, the adaptive interface only presents the user with the relevant input fields and menus according to the selections made in the options menu, keeping the model building effort at a minimum. PROSPER has evolved into the industry standard for well and pipeline modelling due to it's unrivalled sound technical basis and unique modelling capabilities. The program today forms one of the foundation stones of the Digital Oil Field system, and the calculation engine is utilised by numerous workflows in real time on hundreds of fields world-wide.

OUTFLOW (VLPs) MODEL



As part of the package of unique features available in PROSPER, research being conducted since Petex was founded has resulted in the creation of a number of proprietary multiphase flow pressure drop models (both empirical and mechanistic). The objective of this research has been to create fundamentally rigorous models that overcome the limitations of traditional models available in the industry. Petex is uniquely placed to have access to data from all over the world and over the years, a comprehensive database of pressure drop measurements has been created, which allows our researchers to compare novel physical models to real world information. Independent comparisons done by industry experts in multiphase flow have proven the reliability and consistency of the Petroleum Experts pressure drop models, to the point where these models are being widely used to quality check measurements obtained in the field. As part of a clearly defined well test quality check workflow, users have the ability to compare and contrast the behaviour of traditional pressure drop models with the ones uniquely available in PROSPER in order to assess suitability and consistency over the life of a well. Should users choose to use third party pressure drop models such as OLGAS or LEDAFLOW, these are also available as plug-ins, provided that the relevant licenses from the third party vendors are put in place.

INFLOW (IPRs) MODEL



A comprehensive set of inflow models complement the multiphase flow capabilities in PROSPER, enabling Nodal Analysis calculations to be done for virtually any type of well. There are over 20 inflow models that have been developed over the years, that can be applied to horizontal, vertical, deviated, multilayer and multilateral geometries. Furthermore, novel development has seen the realisation of unique inflow models that account for changing PVT conditions in the well drainage area as well as in multiple zones. This allows re-perforation studies, analysis of skin, the application of sand control measures and many other sensitivities to be conducted easily.

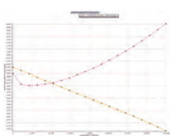
MULTILATERAL COMPLETIONS

Alongside all of the analytically derived Inflow Performance Relationships available in PROSPER, the Multi-Lateral IPR model is the culmination of extensive research and has been designed specifically for complex well completions that have undulating trajectories across multiple producing zones. This is the most advanced analytical IPR that exists in the industry today and can only be found in PROSPER as another one of the many unique features in the program.

PROSPER

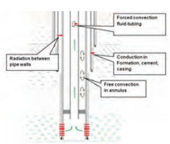
MULTIPHASE WELL AND PIPELINE NODAL ANALYSIS

INFLOW/OUTFLOW RESPONSE



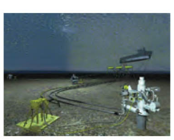
The rigorous multiphase pressure drop models and unique list of inflow performance relationships come together to form system calculations for well and pipeline models. This allows for assessing the productivity of oil, gas and condensate wells to be performed, both for production and injection scenarios, with or without artificial lift. Sensitivities can be conducted through a simple interface that allows the investigation of virtually all parameters that are inputs to the models and the matching workflows allow for comparisons to be done between the results predicted by the models and the measurements obtained for these wells if they are already operational.

THERMAL MODELLING



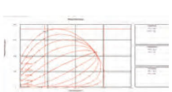
PROSPER is capable of modelling thermal profiles in wellbores using multiple methods, ranging from a constant rate of heat transfer (Rough Approximation) through to a detailed and rigorous full energy balance (Enthalpy Balance) that considers the forced and free convection, conduction and radiation heat transfer mechanisms. The latter considers a detailed materials specification, and to aid with this PROSPER has been furnished with a database of common casing, tubing, cement and mud descriptions with their associated heat transfer properties. Users can also take advantage of a hybrid thermal calculation technique that was developed by Petex (Improved Approximation). This allows for Joules-Thomson effects to be captured in the well, while at the same time enabling multiple heat transfer coefficients with depth to be used.

FLOW ASSURANCE



Flow assurance studies are an integral part of any pipeline and well analysis, done both for designing and troubleshooting purposes. In PROSPER many years of research have been dedicated to addressing these issues and users can study either hydraulic flow assurance challenges, or issues related to the thermodynamic behaviour of fluids. Hydraulic investigations can be conducted on flow regimes, erosional velocities, superficial velocities, wellbore stability analysis (liquid loading), slug catcher sizing and many others. Thermodynamic calculations can include studies on hydrate formation, waxing, salt precipitation and others. PROSPER will indicate where in the system these issues might occur and the user has options to consider intervention (e.g. hydrate inhibition, surfactants, etc.) or changing the operational conditions (wellhead pressure).

FULLY COMPOSITIONAL



As is the case with all the programs developed by Petex, PROSPER uses a powerful thermodynamics engine to complement the traditional black oil models that provide all the thermodynamic properties needed for the pressure drop, flow assurance and inflow calculations. In fully compositional mode, PROSPER allows users to take advantage of advanced hydrate prediction and mitigation calculations, salt deposition, special handling of CO_2 for dense and light phases and many other functionalities. In black oil mode, a large number of correlations are available that can be compared and matched to lab data. Special correlations for heavy oils have been implemented and these, coupled with an emulsion model as well as special heavy oil pressure drop models, make PROSPER unique in being able to deal with such fluids and the intricacies of producing them. Another feature that is widely used is the ability to predict the vaporised water that is produced from gas wells. This is based on industry standard calculations that have been modified based on data received from clients to create a uniquely accurate model for analysing this situation.

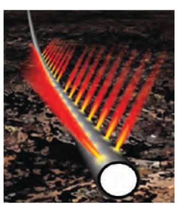
PROSPER

MULTIPHASE WELL AND PIPELINE NODAL ANALYSIS

ARTIFICAL LIFT SYSTEMS

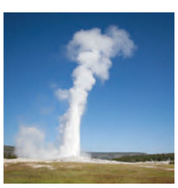
Artificial lift design and troubleshooting has been an area where PROSPER has offered unparalleled modelling capabilities to the user community for many years. Gas Lift, ESPs, HSPs, Coil Tubing Gas Lift, PCPs, Jet Pumps, Sucker Rod Pumps are only a few of the many lift mechanisms that can be evaluated for new and existing installations. With every new release of the program, one or more methods are added and the capability of the existing methods are enhanced. A database of equipment (Pumps, valves, motors etc) is available and is being updated every year as new descriptions become available. Unique features include the Quicklook troubleshooting workflows, minimum energy methodologies for HSP wells, designs that consider the inflow performance and many others. The latest addition to the list is a Fully Transient Gas Lift Simulator, which simulates the unloading phase of gas lifting and allows users to assess the stability of such wells. All the artificial methods available can be made part of a bigger network model (GAP) for full field optimisation as well as the Digital Oilfield systems where they can form the basis of any workflow that users wish to automate (for surveillance, diagnostics and others).

PERFORATION DESIGN AND PERFORMANCE



As part of the philosophy of sharing knowledge among operators in the industry, Shell has contributed their proprietary perforation optimisation tool (SPOT) which can now be found as part of the standard toolkit of calculations in PROSPER. The objective of this module is to allow engineers to compare the perforation charge performance and assist in selecting the optimum perforation gun. This can be done through the charge properties, rock properties (averages of obtained from logs), fluid properties and by using appropriate drilling mud invasion models. It can handle open hole completions as well as cased hole completions. The implementation in PROSPER allows the output of SPOT to be directly combined with the vertical lift performance models to predict the complete well performance, therefore eliminating the artificial boundary conditions that would need to be put in place if only the inflow part of the well was considered.

STEAM WELLS



Steam injection wells (SAGD, Huff and Puff, Direct Steam Injection) are becoming more common in the industry and modelling of such systems can be done through a variety of tools in the IPM Suite, primarily REVEAL. PROSPER is also steam enabled and if the wells to be modelled relate to steam injection systems, then lift curves can be generated that can be used to model steam distribution systems (in GAP). In creating integrated steam injection systems models, the efficient designs of the network, analysing the operating envelope limits, evaluating energy management and the economics are now feasible for what have traditionally been a costly operation.