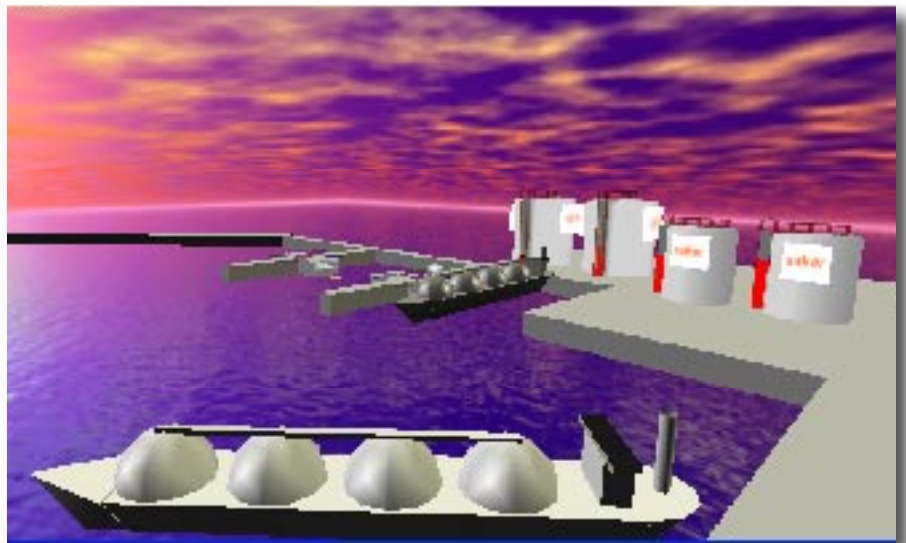


Simulation in the oil & gas sector



There are very few other industrial sectors where the capital and operational costs of facilities approach that of the oil & gas industry. New projects, such as oil or gas processing plants, refineries, LNG (Liquefied Natural Gas) and GTL (Gas to Liquid) plants involve investments frequently running into billions of dollars. Operational costs are also very significant; the cost of chartering ships is tens of thousands of dollars per day. Seeking and exploiting opportunities for cost reduction and increased revenues can yield large dividends and have a material effect on margin.

Whilst the performance of an asset is important at an individual level, the holistic performance of the asset portfolio is fundamental. Because of the strong interdependence between assets, combinations of changes may prove to be synergistic and lead to much bigger returns. Conversely the outcome of combinations of changes is sometimes counterintuitive and could prove disastrous if implemented. The changes under consideration may involve one of more parts of the value chain...

Value Chain



Note that within the value chain, there may be more than one asset at each stage. For example, multiple production trains, multiple storage tanks, multiple berths, multiple ships and multiple customers, with each entity having its own attributes and characteristics. It may also be the case that multiple products are involved.

To analyse the aforementioned complex systems in order to improve the quality of decision making, Oil and Gas companies around the globe are using simulation modelling. By using simulation to conduct a series of 'what-if' analyses, Oil & Gas companies can ascertain how improvements can be made and benefits realised.

Simulation modelling involves creating a computer model to mimic a real production or logistics process. Simulation's unique time based approach, in conjunction with the ability to reflect the random variable factors (such as weather), enable simulation models to accurately mimic the complexities of real life systems. Frequency and persistence of weather patterns, plant failures and equipment outages are accurately reflected using statistical distributions to represent the variations that would naturally occur. Simulation enables proposals to be fully validated and allows the interested parties to arrive at a consensus reinforced through a proven methodology. The uncertainty and risk associated with major business decisions involving extremely complex processes is mitigated.

Simulation models encompass a dynamic animation reflecting the status of all aspects of the model. For example, ships move between ports, inventory levels fall and rise in accordance with demand and production respectively. The animated simulation screen makes use of icons to represent the products and equipment. In the latest simulation software, leading edge graphical technology is used to provide accurate 3d animations which are immediately recognisable as scaled, accurate simulation models of the real facilities. This provides a superb communication medium for all interested parties, thus ensuring that all parties involved in the decision process have the maximum understanding of the issues involved so that the simulation software can be used to help drive through real performance improvements.

Benefits typically fall into one of three areas...

1. Cost Reduction and Deferment

The possible options for reducing costs are frequently perceived as possible threats to production or delivery performance. Options under consideration may involve the plant at equipment level, the configuration of storage, loading or discharging processes and shipping fleet portfolio. By simulating a facility or system, 'what-ifs' can be performed in order to strike the right balance between capital cost and a performance which is acceptable to all parties. Using simulation, expenditure can be avoided, where the return on investment would fall short of expectations. Simulation also provides the means to maximise return by avoiding the premature introduction of redundant capacity; instead additional capacity is deferred until the bottleneck asset is fully utilised.

With regard to operational expenditure, the ongoing costs of maintaining all existing assets can be challenged; this may provide a business case for the decommissioning of a poorly used asset. Simulation has been used to...

- Substantiate the benefits of retiring a ship from a logistics circuit and avoiding tank-tops by hiring ships on a cost of affreightment basis.
- Corroborate that the remediation all storage cells at an export terminal is unnecessary and that the production would not be compromised if two cells were decommissioned.

2. Justification / Proof of Concept

Simulation provides the means to discover the most cost effective means of achieving a particular goal. 'What-ifs' can be performed to compare alternative scenarios to identify the best balance between performance and capital expenditure. Performance may involve security of supply, avoidance of tank-tops, avoidance of demurrage costs, or ensuring production targets are met.

Simulation enables all business cases for investment to be reinforced through a proven methodology; moreover, solid proof of the benefits can readily be demonstrated.

3. Greater Efficiency leading to Increased Revenues

For a given system encompassing a portfolio of assets, it is possible to discover how the portfolio can be used in a 'smarter way'. For example, how cargoes should be allocated to individual ships to maximise the utilisation of the fleet to exploit incremental opportunities. Simulation modelling provides the ability to experiment with existing commitments and potential contracts such that the right amount of contingency is present to protect service/performance whilst operating a portfolio to the limit of its holistic capacity. This use of simulation allows all opportunities to be evaluated to understand if they can be feasibly exploited without detrimentally impacting on other aspects of the system or jeopardising client obligations.

How Simulation is used

In oil & gas projects there are an enormous number of variables. These include data on the assets themselves, random events (e.g. weather), cyclical events (such as daylight and tides) and demand profiles. Because of the complexity inherent in the processes, what is not clear is to what extent each of these variables interacts and affects the overall results. Simulation software models allow any parameter to be changed so that potential solutions can be stress tested to ensure that recommendations are robust and well founded.

Simulation Applications

Simulation has been used for these, and many more Oil & Gas applications:

- Validation of new LNG receiving terminal and shipping fleet
- Capacity study for commissioning and configuring berths in expanding shipping port (i.e. determining berth introduction dates and allocation of Oil & Gas products to berths)
- Simulation of a Crude Oil shipping circuit – feasibility of retiring a VLCC (Very Large Crude Carrier)
- LNG ADP generation & testing
- Validation of asset portfolio for new and expanding LNG plants
- Jetty simulation models of export and import terminals undergoing expansion
- Material transportation logistics (e.g. pipeline construction)
- Evaluation of cell storage requirements for oil export facility
- Validation of tank farm configuration
- Determining the deliverability of oil / gas / LNG plants
- Expansion of a road tanker export facility
- Reliability modelling

Benefits Achieved

Example benefits as a result of using simulation within oil & gas operations are:

- \$15m in additional revenues from an additional LNG cargo delivery
- \$50m+ cost avoidance in an SBM (Single Buoy Mooring) by optimising the commissioning dates for shipping berths and optimising the allocation of hydrocarbon products to berths
- Ability to retire a ship from a crude oil shipping circuit
- \$60m cost avoidance in a LNG tank at a receiving terminal
- Proof that the operation of a proposed oil & gas receiving terminal was feasible without building breakwaters thus leading to significant capital savings
- Proof of concept for a new LNG plant and shipping fleet
- Major operational savings by proving that the remediation of all storage cells in a crude oil export terminal was unnecessary

Oil & Gas companies using simulation include: BP, Shell, ExxonMobil and ChevronTexaco. Typical simulation software applicable to this sector includes Flexsim, Extend, Arena, Witness and Simul8.

For more information

Visit the simulation centre at www.sakersolutions.com for the latest information on business simulation solutions or call 01527 892296 or email info@sakersolutions.com.

About Saker Solutions

Saker Solutions has been launched to provide a one-stop shop approach to simulation. Linking with some of the worlds leading product developers and utilising experience from across the world Saker Solutions is able to offer its clients the right solution for their needs. Saker Solutions can advise on the right simulation product for the job or provide tailored solutions based around a range of tools always ensuring that their client receives maximum benefit from their investment.

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