ResAssure

Introducing World's Fastest Reservoir Simulator

- Reserves Assurance
- Uncertainty Modelling
- History Matching
- Reservoir Simulation

![ResAssure logo]

OVERVIEW

- **ResAssure** is an innovation in reservoir simulation and solves fully-implicit, dynamic three-phase fluid flow equations for every geological realisation

- **ResAssure** achieves incredible reservoir simulation speeds (~1000 times) compared to any conventional reservoir simulator

- **ResAssure** provides probabilistic analysis of oil and gas reserves

- **ResAssure** narrows the range of uncertainty in reserves estimation

- **ResAssure** is a fast, powerful, intuitive cloud based solution

What is ResAssure?

ResAssure is a Stochastic Simulation software solution. Its innovation in reservoir simulation lies in solving fully-implicit, dynamic three-phase fluid flow equations for every geological realisation.

ResAssure marks a significant milestone in the history of reservoir simulation, leading technological advancements in the oil and gas industry. It has been developed to work with standard reservoir simulation package datasets.

What makes ResAssure unique?

The robust simulator enables ResAssure to conduct the stochastic simulation of hydrocarbon reserves. This significantly reduces the risk in development of oil and gas fields and narrows the range of uncertainty in reserves estimates. This revolutionary software facilitates Petroleum Engineers to overcome the current limitations in the industry for conducting reservoir simulation studies.

The impact of uncertain parameters (for example, depth, porosity, thickness) can be evaluated thoroughly by simulating millions of realisations in a fraction of the time compared to conventional simulators.

Engineers can systematically work through all the underlying technical uncertainties and generate far more accurate estimates of hydrocarbon reserves. In turn, this leads to increased value addition by saving time and making sound technical and commercial decisions.

The Speed-Up of ResAssure
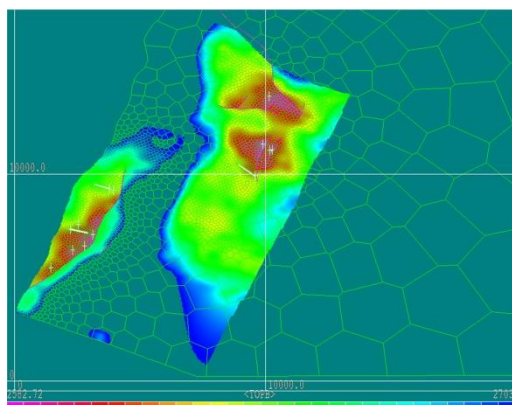
ResAssure's core simulator is built for achieving tremendous simulation speeds using various advanced mathematical techniques.

ResAssure's speed breakthrough is achieved by a combination of proprietary algorithms, polygonal gridding and aggressive spatial coarsening and time stepping.

It provides fully implicit simulation realisations without using proxy or approximation techniques and is able to achieve overnight, what until now would take reservoir engineers years using conventional simulation technology.
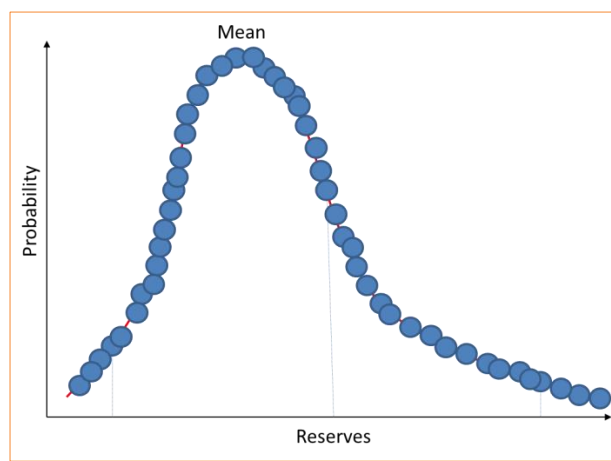
Deterministic Approach vs. ResAssure

Standard practice in the industry is to employ a single "deterministic" model of the sub-surface, often referred to as the "most likely" case, to guide field development planning. A systematic quantification of other feasible outcomes is seldom carried out as it is often considered too difficult, too expensive and too time consuming.

ResAssure performs the massive computation required to generate a complete analysis of possible field outcomes.

Deterministic Approach – Single Reservoir Model
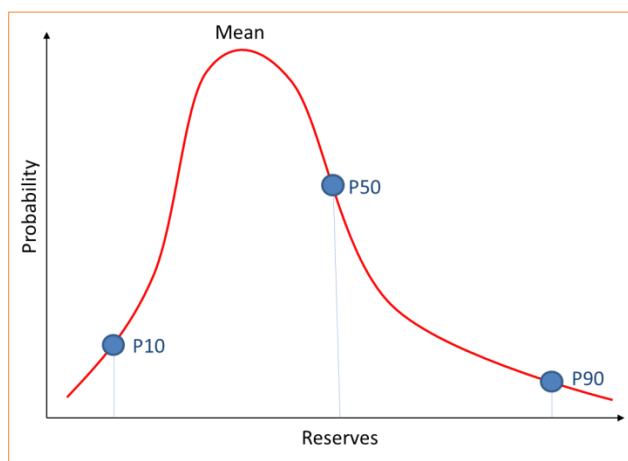
ResAssure Approach – Full Distribution Reservoir Models

ResAssure rigorously quantifies the full range of probabilistic outcomes on which to base development decisions. Unlike the deterministic modelling approach, each and every field development scenario calculated by ResAssure is fully consistent with all available data.

The starting point for ResAssure calculations is a standard simulation data deck (e.g. Eclipse, CMG), which typically only considers a single possible outcome. ResAssure then conducts a constrained random walk through the total solution space to locate all other feasible field development solutions, which could number into the millions.

## Managing Uncertanties with ResAssure

The stochastic simulation of hydrocarbon reservoirs provided by ResAssure reduces risk in the development of oil and gas fields and narrows the range of uncertainty in resource estimates. This reduces the potential for either over- or under-investment and provides an unprecedented level of certainty for oil and gas reserves and project profitability.

Reduce Uncertainty for Mature Fields

Historical production data is used as a quality check for the existing reservoir models. Current history matching methods to identify good sets of history matched models are limited.

As the industry is moving away from a single deterministic representation of reservoir, the existing methods (ensemble or gradient based approaches) struggle to solve the inverse problem. The non-uniqueness in the history matched

solution has been accepted in recent years but long iterative processes requiring a number of simulation runs makes the process difficult. ResAssure can assist in overcoming these limitations.
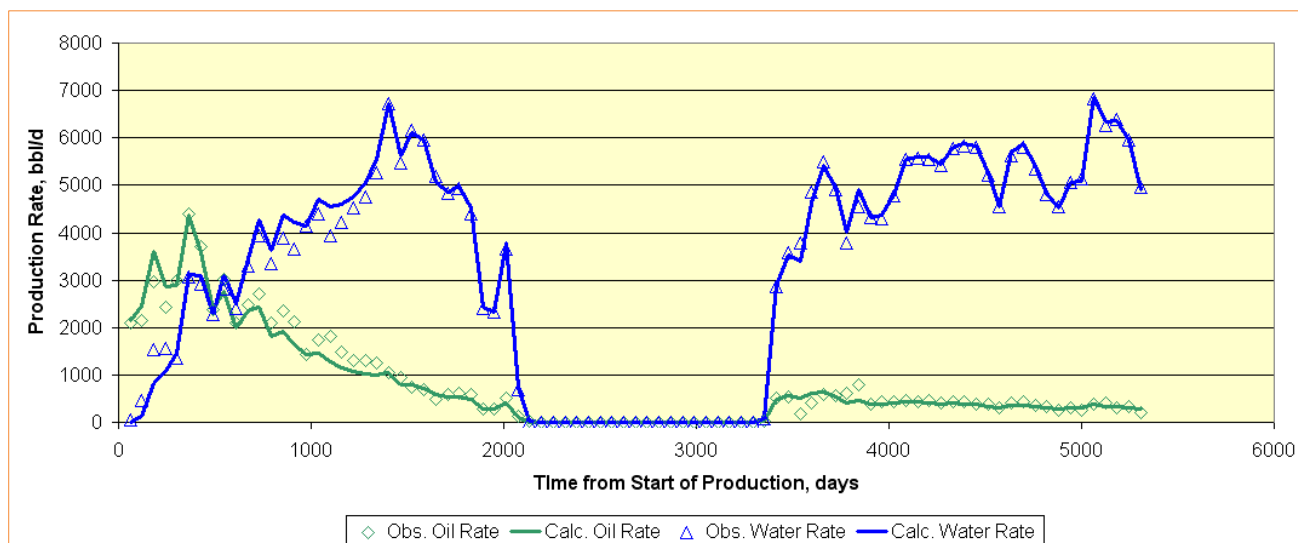
Cloud Based Solution

ResAssure is a Software as a Service (SaaS) solution, deployed using a cloud computing platform.
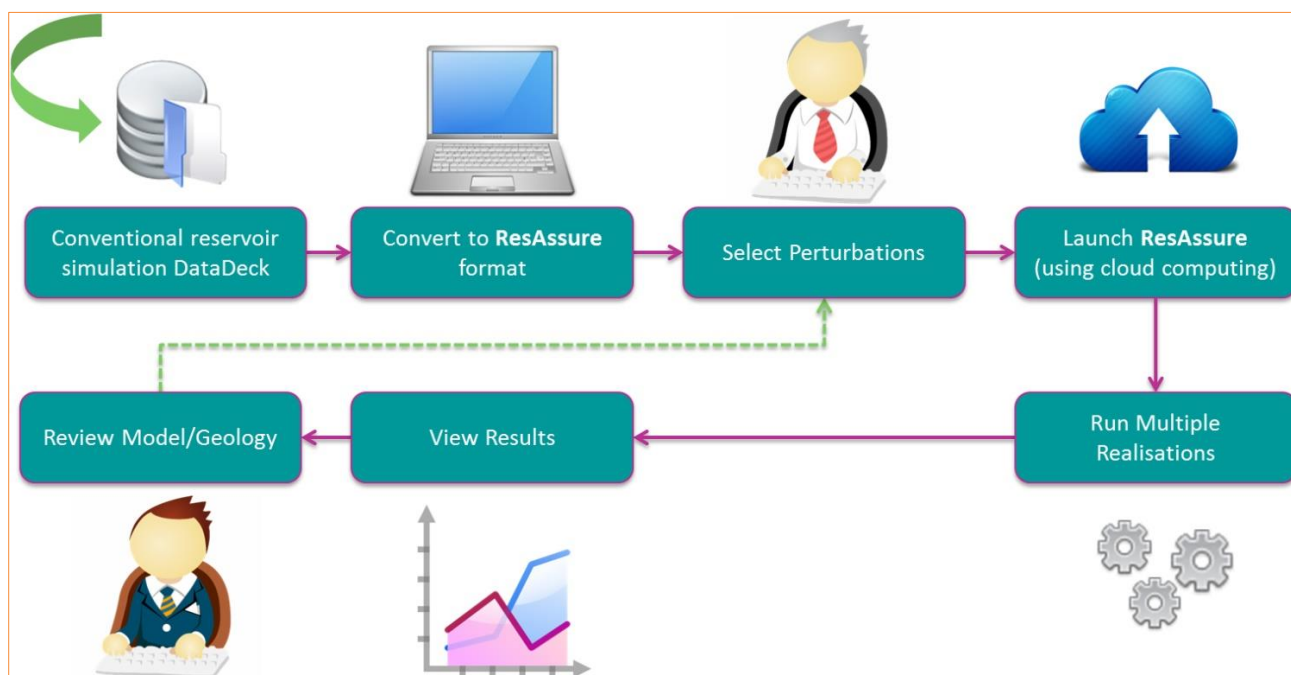
Petroleum engineers and consultants can evaluate their existing reservoir models from standard simulation packages by directly uploading to a secure cloud environment.

After defining the uncertain parameters such as porosity, permeability, fluid contacts and their corresponding ranges in the web interface, users launch the application on the cloud.

Summary

FEATURES	BENEFITS
1. Stochastic simulation of hydrocarbon reserves	• Narrows the range of uncertainty in reserves estimation • Better information for production and financing decisions • Reduces the potential for over- or under-investment
2. Probabilistic analysis of oil and gas reserves	• Facilitates SPE-PRMS reserve reporting requirements • Reduces development and financial risk • Unprecedented level of resource assurance with respect to oil and gas reserves and project profitability
3. Incorporates existing reservoir data about subsurface uncertainties	• Produces far more accurate estimates of hydrocarbon reserves • Generates timely, accurate statistical analysis of the sub-surface uncertainty
4. Advanced proprietary mathematical modelling algorithms that generates a complete analysis of possible field outcomes	• Identifies many thousands of valid models and feasible outcomes as opposed to a 1 single "deterministic" model • Conventional simulators cannot provide timely decision support information
5. Fast simulation speed	• Enables efficient turnaround of stochastic simulation solutions within a working day • 24 hours of computing can generate > 100,000 realisations, each of which is a valid history-match or reservoir forecast • Significantly speeds up the history matching process
6. Cloud based "on demand" solution (Amazon Web Services platform)	• Accessible 24hrs a day from anywhere in the world • Data stored securely • Scalable computing infrastructure (turn on or off quickly) • Software updates can be deployed dynamically (site visit not required) • Enables increased collaboration • Environmentally friendly - 30% less energy consumption and carbon emissions than using on-site servers
7. SaaS and Pay as You Use business model	• Minimal or no large upfront capital expenditure required • Flexible licensing • No major onsite installation required • Access can be shared with multiple users across multiple systems
8. Simple and Intuitive Web Based Interface	• Powerful, easy to use, minimal training required • Few, if any compatibility issues – web based interface will work in many locations, on many PCs without extensive system requirements • Simple and fast implementation

For more information please visit **www.ResAssure.com**