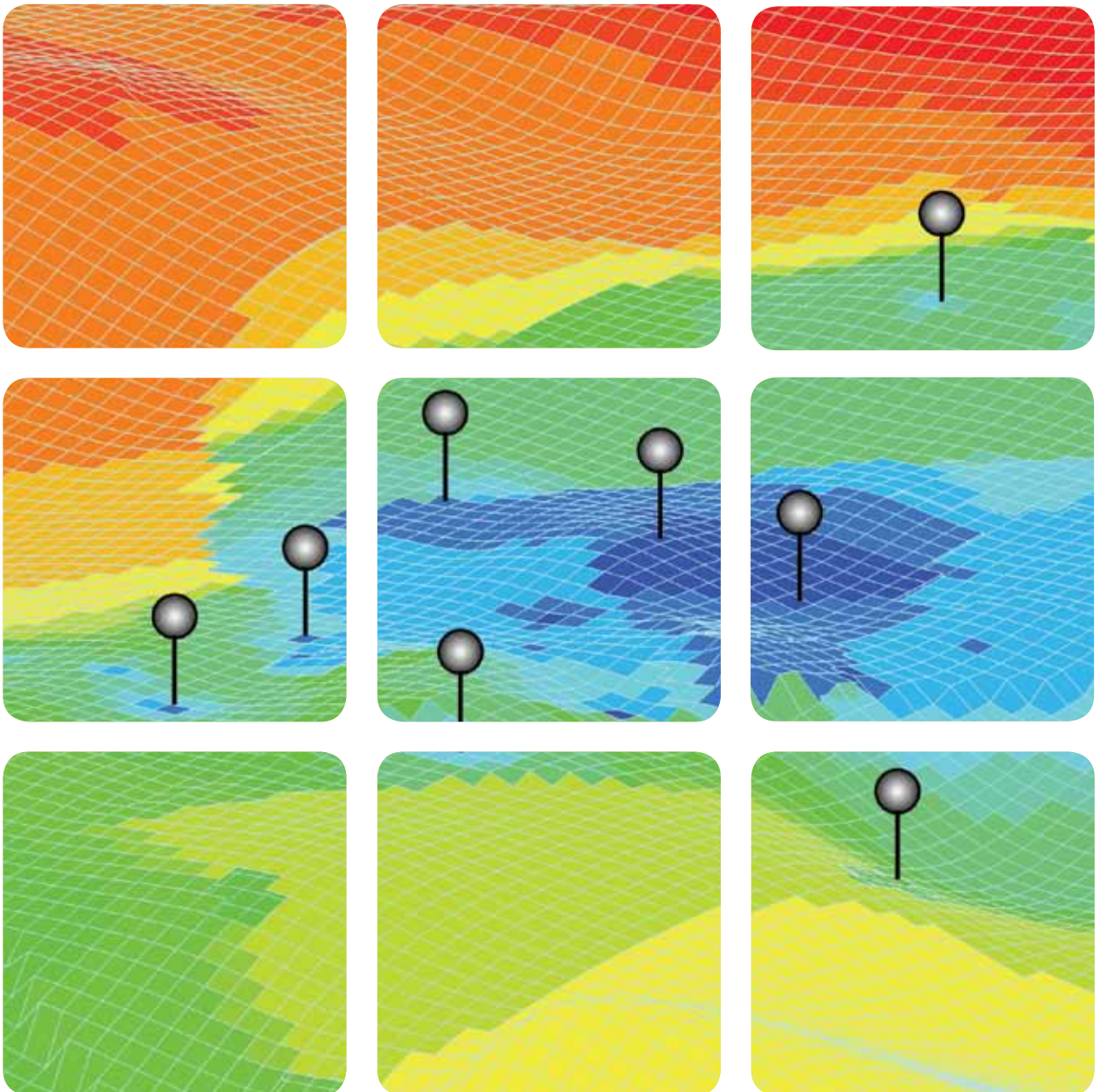


Specialist Reservoir Engineering



RPS Energy - a global energy consultancy

RPS Energy is part of RPS Group, a FTSE 250 company with a turnover of \$700m and 4500 employees. It is one of the world's leading suppliers of independent commercial advisory services, project management and transaction support for the energy sector. We carry out 1000+ projects a year for clients including Governments, NOCs, IOCs, Independents, and Financial Institutions worldwide operating from main locations in the UK, Ireland, the Netherlands, Russia, USA, Canada, United Arab Emirates, Singapore and Australia.



Specialist Reservoir Engineering

RPS offers a broad range of subsurface skills including exploration and production, geology, geophysics, static and dynamic reservoir modelling and petroleum engineering. In addition, we offer specialist reservoir engineering services.

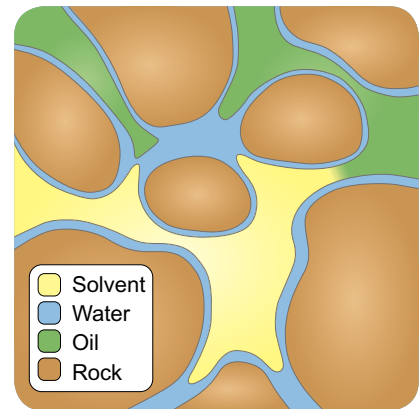
As oil provinces and fields mature, a greater proportion of world oil production will be derived from better exploitation of existing fields and the development of more technically challenging ones. This will require an increased application of more sophisticated technologies targeted at the production of remaining oil. Our Specialist Reservoir Engineering team has expertise in the subsurface dynamic modelling required for application of such technologies for example:

- **Enhanced and Improved oil recovery techniques ('EOR/IOR') particularly:**
 - Screening reservoirs for EOR
 - Thermal methods for viscous ('heavy') oil reservoirs
 - CO₂ injection for EOR and/or storage (sequestration)
- **Coal Bed Methane (Coal Seam Gas)**
- **Integrated Petroleum Modelling**
- **Challenging reservoirs or unusual development scenarios**

RPS Credentials

RPS has a long track record in specialist reservoir engineering. For example, our staff have:

- Screened many fields worldwide for EOR potential for a variety of international clients.
- Systematically screened all major UK oil fields for EOR potential.
- Developed a powerful EOR screening tool, 'MAESTRO'™.
- Written reservoir simulators in use currently which incorporate all the major EOR processes (techSIM™ and SCORPIO™).
- Performed research and written peer reviewed papers on EOR processes.
- Advised the UK government on the application of EOR techniques to UK oil reservoirs.
- Constructed integrated development plans for viscous oil fields including geology, petrophysics, reservoir modelling, drilling and completions.
- Conducted integrated feasibility studies for CO₂ storage in depleted gas fields including reservoir modelling, facilities, well status and re-use.
- Led the dynamic modelling for the UK CO₂ Storage Appraisal Project.
- Developed and applied a screening tool for CO₂ storage and EOR potential for Western Canadian oil fields.
- Performed challenging complex history matches identifying key matching variables.
- Advised clients on the accuracy and limitations of modelling methods used by commercially available reservoir simulators.
- Devised and applied techniques for unusual modelling scenarios.



Enhanced Oil Recovery

RPS has expertise in the three main types of enhanced oil recovery techniques.

Gas Flooding

Gas flooding often requires compositional simulation which may be performed with techSIM™ or commercially available compositional simulators. Gas channelling and viscous fingering may occur and RPS has much experience in designing simulations which adequately capture these mechanisms.

RPS has performed many studies covering all the main varieties of gas injection techniques including:

- Downdip Water Alternating Gas ('WAG') or continuous gas injection.
- Crestal gas injection for gas storage or gravity stable floods.
- Floods for which the injected gas is miscible or immiscible with the reservoir oil, e.g., floods injecting hydrocarbon, CO₂ or N₂ gases.
- Re-cycling of produced gas in retrograde gas-condensate reservoirs.

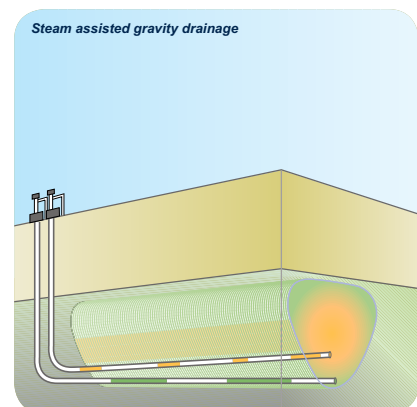
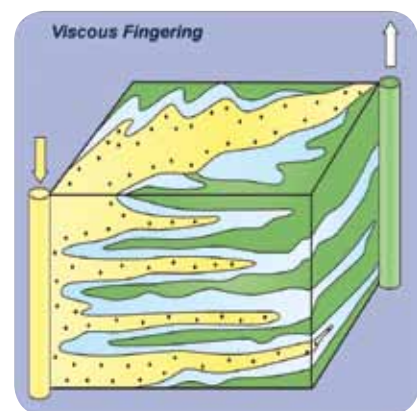
Chemical Flooding

Chemical flooding screening studies can be performed using MAESTRO™. The RPS chemical flooding simulator SCORPIO™ is able to model:

- Polymers
- Gels
- Surfactants
- Combined techniques such as Alkali/Surfactant/Polymer (ASP).

Thermal Techniques

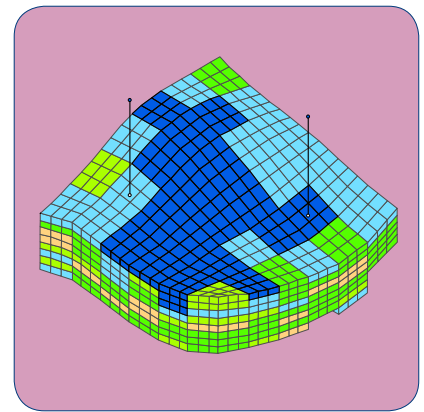
- Hot water flooding.
- Cyclic steam stimulation ('Huff and Puff').
- Steam flooding for fluid displacement.
- Steam assisted gravity drainage ('SAGD').
- In-situ combustion.



RPS Software

As well as a variety of industry standard commercially available software, RPS has the following in-house specialist reservoir engineering software which may be adjusted or extended to facilitate modelling solutions.

- **MAESTRO™** - An industry leading EOR screening programme.
- **techSIM™** - A multi-purpose reservoir simulator incorporating black-oil, compositional, thermal and CBM simulation.
- **SCORPIO™** - A chemical flooding simulator.



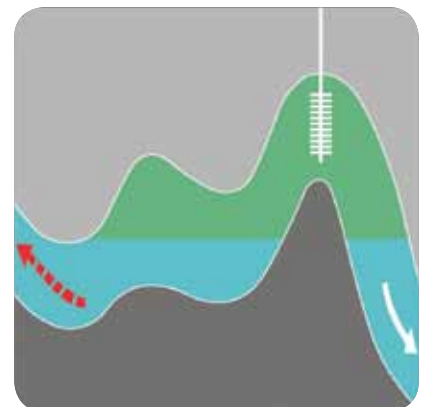
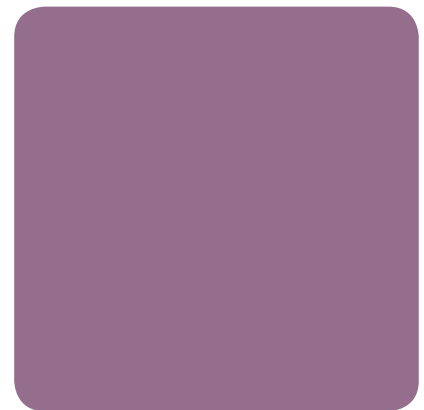
CO₂ Injection for EOR or Storage (Sequestration)

Many projects have been performed for both commercial clients and government including:

- Storage projects in depleted gas reservoirs and deep saline aquifers.
- EOR/storage projects in oil reservoirs.
- Basin potential studies.

Such studies have included:

- Subsurface modelling.
- Risk evaluations.
- Investigations into the re-use of existing wells and other facilities
- Acid gas injection (CO₂ & H₂S) for disposal, or as a chase gas for miscible gas flooding.

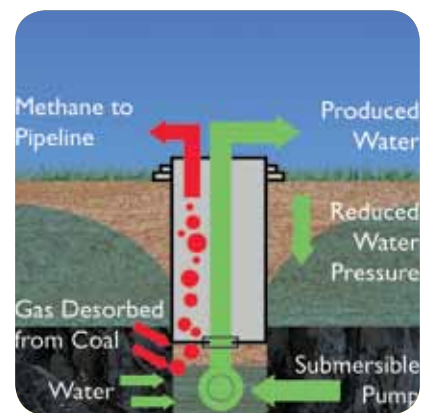


Coal Bed Methane (Coal Seam Gas)

RPS has performed coal bed methane (CBM) studies using both commercially available simulators and its in-house simulator, techSIM™.

Studies have included:

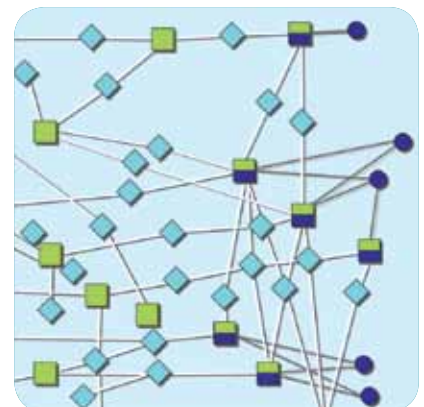
- An investigation into the use of a CBM reservoir for temporary gas storage.
- An examination of the impact of re-injecting produced brine for disposal.



Challenging/Unusual Modelling Scenarios

Examples of projects undertaken include:

- Matching to historical data with a large number of variables in a field producing from many separate reservoirs. Preliminary coarse match was obtained by running material balance models in combination with a simulation optimisation programme (MEPO™). Many possibilities were investigated quickly and more detailed simulations were focussed on a much smaller number of possible scenarios.
- Checking the modelling accuracy for horizontal well production forecasts from a conventional finite difference simulation. The accuracy of the underlying assumptions were checked with a combination of numerical and analytical modelling techniques using our detailed understanding of reservoir simulators and their limitations.
- Integrated petroleum modelling which requires both an understanding of physical mechanisms and different modelling tools.





For further information
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rpsgroup.com/energy