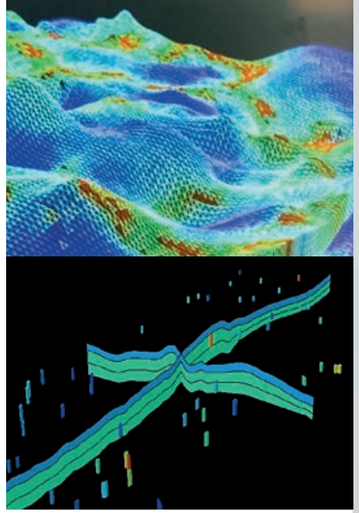
Dr Sebastian Hörning, Energi Simulation Postdoctoral Fellow, and Professor Suzanne Hurter, Energi Simulation Industrial Research Chair.

From university R&D to reality

How industry collaboration can help further unlock Australia's resource base

NERA has partnered with The University of Queensland Centre for Coal Seam Gas (UQ-CCSG) and industry operators to commercialise leading research that will improve the accuracy of the resource models used in the Coal Seam Gas (CSG) industry, contributing to more cost-effective resource planning. The challenge is to select the 'right' data to use for specific purposes and design data processing tools that accurately represent the behaviour of different parts of the system.

Against the backdrop of deepening data pools and an increasingly interconnected world of technology, mobile devices and the Internet of Things (IoT), for Australia's energy resources sector, the central question – one shared by many industries – is 'How can we use data better?'



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The Spatial Copulas (or non-linear geostatistics) project is helping industry use data better.

The energy resources sector uses advanced modelling techniques to produce estimates of reserves and plan resource production. Resource modelling uses large volumes of data, particularly spatially referenced data, to inform critical business decisions. While it is important to determine how to manage the volume of data, it is also critical to ensure that the models provide a good representation of relationships between different datasets and the different properties of the system being modelled.

Known as the Spatial Copulas (or non-linear geostatistics) project, this initiative aims to integrate the computer code developed at UQ with leading industry standard modelling software to ensure that it can be used industry-wide. The project not only has the potential to save industry millions of dollars through better field design, it can also improve our understanding of Australia's resource base and reduce environmental impacts through more efficient operations.

Computer modelling is widely used by industry and government to simulate what might happen in different situations. These models touch our lives in many ways, providing critical input to decision making processes in diverse fields such as emergency services response, water resource planning, weather forecasting and transport systems. They are reliant on the selection of the 'right' data, the quality of the data and the processing techniques, as well as the processing capacity.

The project arrives at a crucial juncture for the energy resources sector, with demand for natural gas expected to increase by 50% by 2040 and the number of CSG wells in Queensland expected to at least double over the next decade. Developing modelling techniques that more accurately represent spatial relationships will contribute to the optimum placement of CSG wells – with potential to reduce overall well numbers while improving gas recovery, minimising environmental impacts and limiting disruption for landholders.

This project plays a role in the digital transformation process for the oil and gas industry which, according to the World Economic Forum (2017), could unlock approximately $1.6 trillion in value for the global industry, its customers and wider society.

Analysing bigger, more complex data to forecast resource reserves

To identify potentially untapped resources, Australia's CSG industry relies on a technique that uses mathematics and statistics to estimate where gas and water might be located through a process known as geostatistical modelling. When performed over large areas, these estimations are often based on the measurements of two adjacent areas, with data used to predict where resources might be located.

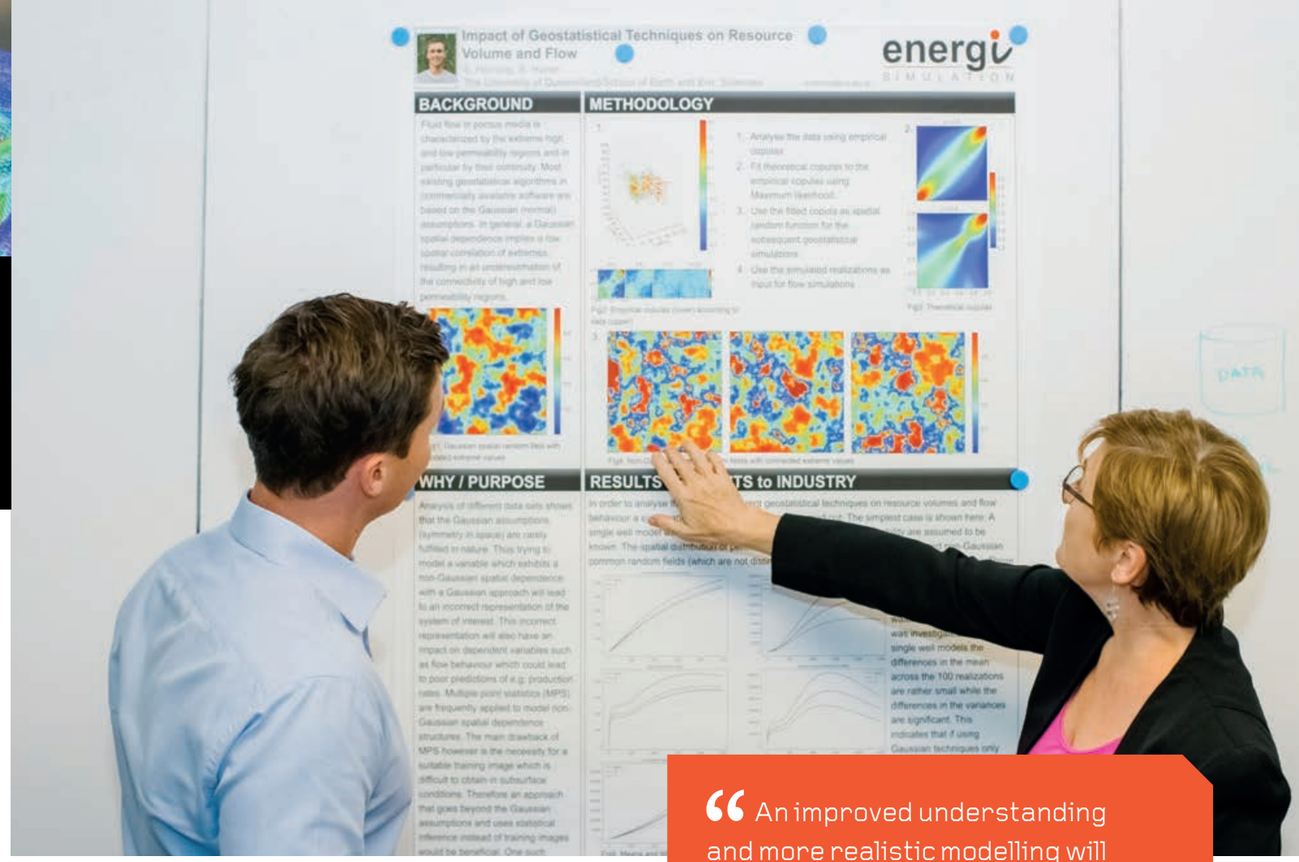
But what if current modelling isn't providing the answers industry is looking for?

This question was posed by industry at one of the UQ-CCSG's workshops designed to identify some of industry's greatest challenges. Industry turned to the UQ-CCSG with a problem: there's a huge amount of data being collected and used in models, but the models themselves are failing to provide the answers required of them. It's a sector-wide challenge that researchers from the Centre, Professor Suzanne Hurter, Energi Simulation Industrial Research Chair based at UQ-CCSG, Dr Sebastian Hörning, Energi Simulation Postdoctoral Fellow, and their team are determined to solve.

The problem for industry arises where current geostatistical methods assume a linear and symmetrical relationship between two areas to make their predictions, without accounting for naturally variable conditions that occur in nature.

"The current industry practice of potential resource analysis has limitations that can create modelling errors, which in turn lead to over- or under-estimation of resources and consequently the drilling of too many or too few wells with very large cost implications," explains Sebastian, lead researcher for the project.

"Conversely, an improved understanding and more realistic modelling will contribute to better informed decisions, better locations for drilling, an increased volume of resources to be tapped and the opportunity for improved production performance, while also reducing expenditure."



According to Suzanne, even modest improvements in resource modelling have the potential to lead to enormous industry improvements.

"To put the potential benefits into context, the industry in Queensland has more than 7,000 producing wells. Over time this is expected to more than double. So, considering that a well costs in the order of $1 million, just reducing the number of new wells by a few percent (without affecting production) could save industry hundreds of millions of dollars," says Suzanne.

Collaboration brings university R&D to commercialisation

The first part of the project has seen Sebastian and colleagues at UQ-CCSG and the University of Stuttgart develop a new research code. This involved systematically comparing numerous traditional (linear) geostatistical techniques to non-traditional (non-linear) methods, creating several case studies. The development of the code then allowed the UQ-CCSG to approach NERA to help take the idea from concept to commercialisation.

By collaborating with project partners including UQ, Santos, Arrow and APLNG, NERA's funding support and industry connections have helped integrate the code into Petrel, the most common modelling package for the prediction of oil reserves and production in Australia.

NERA CEO Miranda Taylor says successes to be realised by the project underline the enormous value from accelerating university research into industry environments to meet operational needs.

"Building a strong basis for R&D and skills in emerging digital and automation technologies is a priority if Australia's energy resources sector wants to remain internationally competitive, and this project is a key example of how investing in new industry–research collaborative programs in the latest statistical analysis techniques can have huge operational benefits for our industry," says Miranda.

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>
> **Dr Sebastian Hörning**, Energi Simulation Postdoctoral Fellow and lead researcher for the project

Impact and value beyond energy resources

This project not only helps better inform industry, but it also has academic and government applicability. From application in groundwater resources management (especially important for Australia) to understanding the distribution of rainfall, this project will benefit the wider Australian community.

"Models are used almost universally in this industry to make decisions that involve large sums of money, as well as by government to evaluate environmental impacts," explains Suzanne.

"The plug-in that this project is developing will be available globally. While the plug-in is specifically designed for the oil and gas industry, the underlying code could be integrated into other software to benefit a variety of stakeholders, especially those who rely on data that is connected to a location."