The IPSM Imperative

Technology that connects surface and subsurface teams will be the key to removing silos in an energy industry that is both growing and transitioning at the same time

Optimization is on everyone's minds these days, and the energy sector is no exception. From enhancing operational efficiency, to creating new business opportunities, as well as reducing carbon emissions, the industry is drawing on technology to be better, and do better. That technology is called Integrated Production System Modeling, or IPSM for short. To learn more about the impact IPSM is having on the energy industry we spoke to leaders at Shell, Chevron, Petrobras and CMG who shared their insight on how IPSM can improve the relationship between surface and subsurface operations, and in turn optimize not just energy extraction, but energy transition too.

PARTICIPANTS

Dave Reid
Senior Vice President,
Subsurface and Development Deepwater
SHELL

Justin Lo
Technical Manager,
Enterprise AI
CHEVRON

Roberto Motta Gomes
Reservoir Manager
PETROBRAS

Pramod Jain
CEO
COMPUTER MODELLING GROUP (CMG)

ROUNDTABLE

Connecting surface and subsurface teams

This treehouse game starts with two empty Campbell soup cans and a string.

Perhaps you remember experimenting with "phones" like this when you were younger?

You tie a knot at the end of each string and insert it in a hole in the bottom of the can so they are connected. From there, you sit across from a friend and hold the can up to your mouth to say something while the other person holds it up to their ear to listen.

"I can hear you," someone undoubtedly shouts excitedly. The game is a simple illustration of connecting people over distance so they can share information, and the string always gets the kids excited and undoubtedly elicits some "oohs and ahhs."

We've come a long way from needing to communicate through soup cans, of course, but in the energy industry the treehouse analogy still illustrates the problem of silos, and connecting people across distances — a problem that is very real when it comes to connecting surface and subsurface teams.

Subsurface teams predict and optimize the flow below the Earth's surface, while production teams find the most efficient well and facility configurations to ensure value maximization. The two siloed teams will communicate and share data, but in many operations the technology being used offers little more than the soup can experience.

It's low-tech (here's looking at you, spreadsheets), it's slow, and it's inefficient. Surface and subsurface teams have far better technology that can be used to unsilo the teams, but the problem is it's not being used as widely as it should.

We're talking about Integrated Production System Modeling (IPSM) which can help to seamlessly connect surface and subsurface teams, enabling a more holistic view of a project from end-to-end. And perhaps most importantly, IPSM (also called Integrated Asset Modelling or Management (IAM) or Integrated Production Modelling (IPM)) provides one, single source of data which all teams have access to, and can use.

IPSM is not a new concept, but advancements in digital solutions, machine learning, artificial intelligence (AI) and supercomputing are

> The heart of the problem that IPSM seeks to solve is removing silos.

helping IPSM technology to optimize and deliver opportunities to the energy sector that didn't exist before.

At a high level, IPSM facilitates cooperative gathering, analysis, and organization of data to derive insights and a holistic view of an entire asset. Insights are used to optimize performance of the asset, which in turn enables energy companies to enhance operational efficiency and explore new business opportunities.

And the most important part is that traditionally siloed teams (surface and subsurface) can become one.

To dive deeper into how exactly IPSM reduces siloes, enables innovation, and creates opportunities for growth, we hosted a roundtable discussion on the topic with leading industry experts, including:

- **Dave Reid**, Senior Vice President, Subsurface and Development Deepwater, Shell
- **Justin Lo**, Technical Manager, Enterprise AI, Chevron
- **Roberto Motta Gomes**, Reservoir Manager, Petrobras
- **Pramod Jain**, CEO, Computer Modelling Group (CMG)

These leaders say the time is now for the industry to begin using IPSM as a tool to create more synchronous and efficient surface and sub-surface collaboration.

Removing silos will reduce risk

What often happens in the energy industry is that subsurface and surface teams use different technology systems to assess their part of an operation.

The information they gather and use covers everything from reservoirs and wells, to flowlines, processing and export facilities. The data generated in those processes is collected separately, and then brought together for review and analysis.

It's not an ideal scenario. Disjointed models create inefficiencies and lead to suboptimal decision-making — a major issue in today's energy industry where focus is put on brownfield optimization, which requires doing more with existing operations.

The problem is compounded when dealing with high-stakes offshore plays such as large complex operations like deepwater assets or floating LNG plants. With multi-millions of dollars at stake in these projects, maximizing efficiencies and production is a top priority for these and other assets.

The advantage of IPSM is that it connects the surface and subsurface data simultaneously, which can significantly increase efficiency, says Pramod Jain, CEO of Computer Modelling Group (CMG).

"The heart of the problem that IPSM seeks to solve is removing silos," Jain says. "You ensure there aren't two versions of the truth with data and models. You want to make certain that all teams look at that single version of the truth and that each team is collaborating."

IPSM integrates information gathered from the subsurface and production to export, promoting multi-disciplinary, collective decision-making.

Production system optimization (PSO) is one of the most important uses of IPSM. Other exploration and production uses include field development planning, forecasting, and surveillance, and IPSM plays a big role in energy industry transition and growth.

Where we are today — innovation to increase efficiency and sustainability

Gathering data and making it visible for decision makers has always been a priority for operators of energy assets, says Justin Lo, Technical Manager, Enterprise AI at Chevron.

"If we don't provide the right data to the right people at the right time, we won't be able to make the right decisions," says Lo, whose career has been in the data science and analytics space, and is now looking at how AI can play a role across all lines of businesses.

For their delivery of solutions via digital platforms, Chevron is focusing on cross-platform opportunities to support business workflows that give line of sight to both subsurface and surface.

"The opportunity with IPSM can be realized when you organize data differently compared to the past," he says.

For decades, Lo says people would spend an enormous amount of time and money to structure the unstructured data for analysis.

"Now, AI is flipping that upside down, and we might not have to invest as much in structuring data," he says. "We can leverage AI to gain insights from files with text, schematics, images without having to turn this data into rows and columns. AI is bringing a significant change, and there will need to be a new strategy for data management practices."

But technology isn't the only solution, Lo adds. He says business processes also need to be changed to ensure the connection is happening with technology and the people using it.

"By better connecting these silos you can maximize the impact that this data could have," he says.

The world of reservoir engineering was much different 20 years ago, adds Roberto Motta Gomes, Reservoir Manager of the Libra project at Petrobras.

Gomes says the industry is now moving to integration.

"That means you have to understand problems as a team — and not individually. It requires different discussions and a more well-rounded view of the problem so everyone can contribute."

Gomes is excited by the opportunities IPSM will bring to unlock reserves and identify new solutions.

"IPSM can really help us with our projects," he says, particularly with its more complex revitalization projects. "IPSM supports us with tools to run all of these alternatives to select the best one."

For example, Gomes points to the Libra consortium that is evaluating a project that intends to produce two different reservoirs with completely different fluid compositions.

"IPSM will be essential for designing this project, considering the need for optimizing different composition fluids in the topside and the productions from different reservoirs," he says.

The Libra consortium is operated by Petrobras (which holds a 38.6% stake) in partnership with Shell plc and TotalEnergies (19.3% each), CNPC and CNOOC (9.65% each), and PPSA (3.5%), representing the government in the non-contracted area.

> "Being successful with IPSM will require multidisciplinary input and thought, which is a challenge for an industry that has grown up in silos."

According to Gomes, IPSM allows the consortium to select the best concept that simultaneously combines the production of different reservoirs, maximizing production, and minimizing greenhouse gas emissions.

"The process will also help the company achieve the lowest CO_2 footprint, which is an important challenge for the energy sector that seeks to extract more value from assets, as well as reduce emissions. For both of those things to happen together, there will need to be integrated models and new techniques."

And while the industry's learning curve with IPSM has been long, the increase in computational power will accelerate progress. "IPSM will deliver on better expectations or better forecasts of assets," he says.

What's holding the industry back from greater tech innovation?

IPSM is a proven and viable solution, but the implementation and maintenance have traditionally required a change in mindset and work environment. In addition, IPSM success has relied on subject matter experts being involved in implementation and operation, so organizations that lack those resources have sometimes viewed IPSM as niche, or a nice-to-have solution.

"Being successful with IPSM will require multidisciplinary input and thought, which is a

challenge for an industry that has grown up in silos," says Dave Reid, Senior Vice President, Subsurface and Development Deepwater at Shell.

Reid notes IPSM is also mathematically complex and involves different mathematical equations.

For instance, teams need to solve problems with multiphase fluids, pressures, and temperatures across interconnected production systems, water production optimizations, and different facility constraints — to name just a few of the vast production assets that are needed.

Reid adds that cost is also a factor to consider, especially with deepwater operations.

"Deepwater and onshore are different," Reid explains. "With deepwater, the risk and cost can be significant if you get it wrong. With onshore, there are many decisions, but they are lower-cost, and you can change course more easily."

While a meaningful investment is required for the technology and training, Jain of CMG describes the business case for IPSM as being "rock solid."

He says the biggest investment is in training people to work more efficiently with the help of technology, but because of the net present value of these projects, they are paying for themselves.

According to Jain, the key is ensuring teams, such as reservoir and production engineers, work together on one tool and make decisions accordingly. "That needs to happen more and more in the industry for IPSM to take off," he says.

> "It allows you to optimize the system and facility design upfront, and continue to run the model and optimize production as you go."

Opportunities: Better decisions, better outcomes, bigger future

The energy industry is both growing and in transition.

Managing these dual challenges requires expertise, which includes a broad spectrum of reservoir engineers, petroleum engineers, production engineers, technologists, and well and completion specialists.

Most of these professionals have yet to work across systems. But with innovation comes an opportunity to break up a siloed approach and allow experts to access different perspectives, leading to better decision-making.

IPSM provides a platform for these experts to operate facilities, enabling teams to visualize and address bottlenecks and constraints.

"You see better-quality decisions across more ranges of uncertainty," says Reid of Shell.

The result is more production optimization, which generates revenue. For example, a system that may produce 10,000 barrels per day can be optimized to produce 11,000 barrels each day with IPSM.

The profit potential is significant as you have no additional capital cost of exploration. If you scale this up to hundreds of thousands of barrels a day, it is pure profit because your cost base is already there.

Reid references the deepwater business at Shell, which routinely builds IPSM models around its big offshore assets. It enables leaders to make system selection choices, or what he calls "the big decisions," and to optimize them.

"It ensures robustness across a range of subsurface outcomes," he says, which is critical given the uncertainty associated with these operations.

Bringing integrated disciplines together sets the foundation for the best architectural design of a system.

"Getting that right is very important," Reid says. "It allows you to optimize the system and facility

> When you have an asset team with the technology, the computing power, and buy-in from the top, you can do much more scenario planning… and get quick answers.

design upfront, and continue to run the model and optimize production as you go."

How to make IPSM happen: People, process, technology

IPSM is an "open space for new opportunities," says Gomes of Petrobras, but it requires integrated teamwork. It's a harmonization of people, processes and technology, he says.

"It's a more intensive experience…and there's a learning curve," he says.

For instance, Gomes says that a team using the same IPSM workflow becomes more aware of each area's impact on the overall results.

"Work in this shared mode will also open up opportunities for innovation," he adds, helping team members gain confidence to achieve their goals. "But for that to happen, it's necessary to change the culture," he says.

For Jain, the culture is easiest to change when team members can see the difference being made — something he suggests comes with implementing IPSM.

"When you have an asset team with the technology, the computing power, and buy-in from the top, you can do much more scenario planning… and get quick answers," he says. "Then you start to see an impact."

Lo of Chevron says today's leaders are evolving, taking advantage of technologies to innovate and drive change. Some initiatives may seem incremental from one year to the next, but he says they have been impactful over time.

"If we look at how we apply technology to our businesses today compared to a decade ago, things were vastly different," Lo says. "And I would expect that things will be even better and more efficient a decade from now. But still, it's a journey of continuous improvement — it never ends."

Breaking down barriers to build the future of energy

The industry will need to overcome its traditional way of doing things to make room for a common objective — to produce energy more efficiently and sustainably.

Energy companies play a critical role in helping the world reduce its emissions, and a way to get there is by using advanced technologies that drive efficiencies and deliver sustainability.

"IPSM is about producing more from less. That's why optimization is needed now more than ever," Jain says.

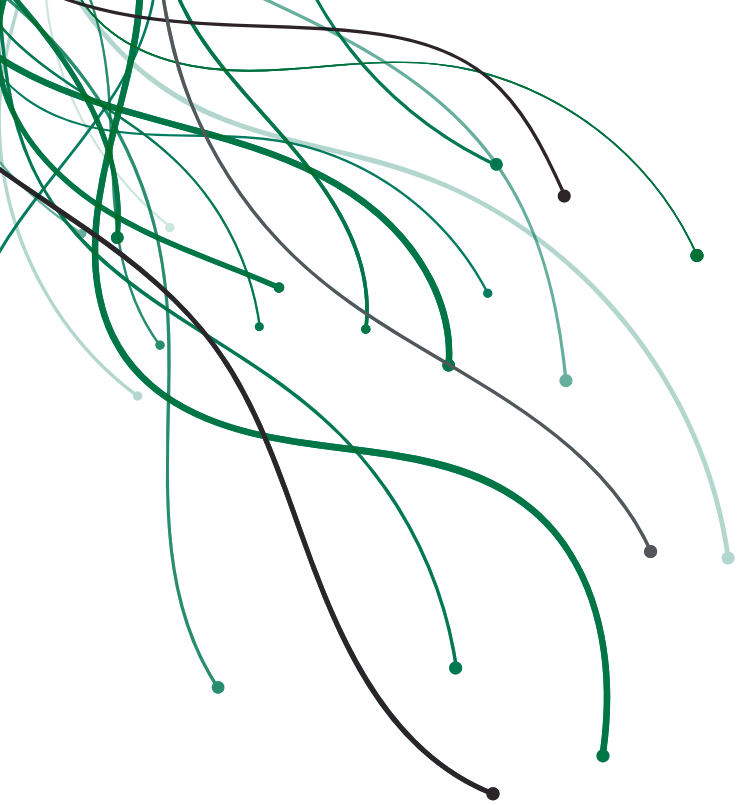
Additionally, IPSM helps to optimize carbon capture and storage (CCS) which is expected to become a key element of energy transition and the ongoing goal to reduce carbon emissions worldwide.

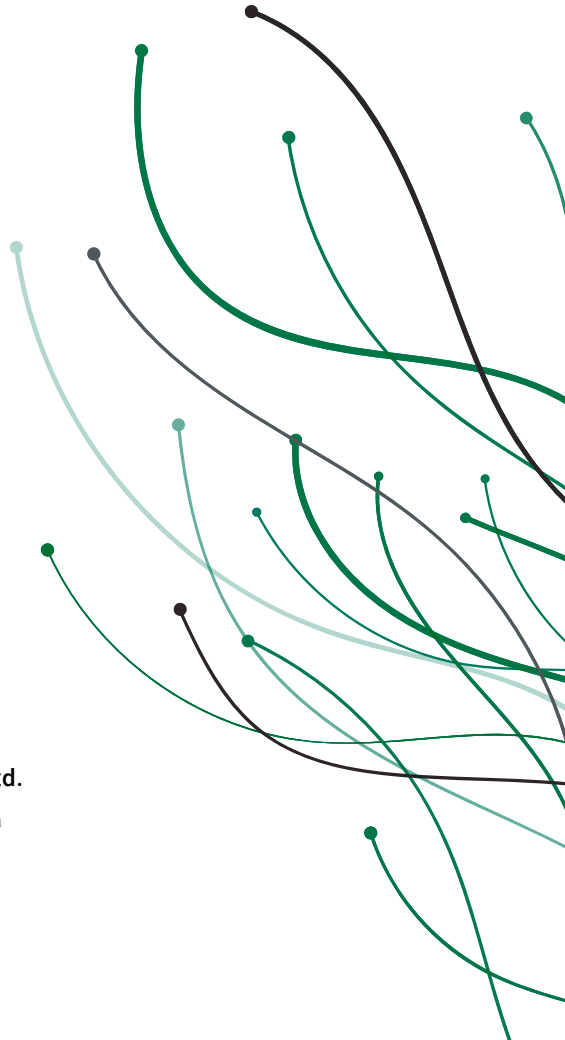
"An integrated model for CCS is critical," says Jain. Especially in a world with ever-expanding energy needs.

"Energy security and sustainability go hand in hand," he says. "This industry will move leaps and bounds towards solving the next frontier, including energy security, reliability, and transition. We have a tough challenge ahead, but with the right technology, the right leadership and the right mindset, we are on the right path." ■

> We have a tough challenge ahead, but with the right technology, the right leadership and the right mindset, we are on the right path.

Innovation to advance a new energy system
Learn more at **cmgl.ca/accelerate**





Published by Computer Modelling Group Ltd.

3710 33 Street NW, Calgary, Alberta, T2L 2M1 Canada
+1.403.531.1300
cmgl.ca