

ACCELERATING DECARBONISATION IN OIL AND GAS COMPANIES WITH DIGITAL TWIN TECHNOLOGY

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DECARBONISATION GOES DIGITAL

Digital transformation technologies can play an important role in enabling the oil and gas sector to become more sustainable, secure and transparent, while meeting the ever-increasing global demand for energy

The global energy system plays a crucial role in driving economic growth, development and societal progress. However, it also poses significant challenges, including energy security, affordability and sustainability.

Achieving these objectives requires a concerted effort from all stakeholders, including governments, businesses and individuals. As leading suppliers to the energy sector, Amazon Web Services (AWS) and Capgemini are committed to addressing these challenges and promoting a more secure, affordable and sustainable global energy system.

Sustainability priorities for oil and gas companies

One of the biggest challenges facing the energy sector is to reduce greenhouse gas emissions and mitigate the impact of climate change, while continuing to meet the growing demand

for energy. Oil and gas companies are crucial players in this effort, because they account for a significant portion of global carbon emissions.

Profit and sustainability must work in tandem. In practice, this means a focus on optimising hydrocarbon production while decarbonising and reducing emissions.

To achieve sustainability and viability in the oil and gas sector, companies must adopt a multi-faceted approach that balances environmental, social and economic concerns. Digital

Digital transformation can help achieve decarbonisation by enabling better monitoring and management of energy use



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transformation plays a crucial role in delivering on this aim.

For example, remote sensing technology, data analytics and workflow automation can help optimise oil and gas production by providing real-time data on environmental and operational conditions. This can help companies better monitor and manage their operations to cut costs and increase efficiency while reducing waste, so companies can lower their carbon footprint.

Digital transformation technologies such as artificial intelligence, machine learning and automation can further help to optimise production processes and reduce emissions.

Companies must also embrace sustainability practices that go beyond environmental concerns. For instance, they can work to enhance their social credibility to operate by engaging with local communities, promoting diversity and inclusion.

The United Nations identified 17 Sustainable Development Goals (SDGs) that are essential for creating a sustainable future for the planet. In the oil and gas industry, there are several key SDGs that are especially relevant, in particular decarbonisation, inclusion and collaboration.

One way that digital transformation can help achieve decarbonisation is by enabling better monitoring and management of energy use. By

using sensors, analytics and other digital tools, companies can gain a better understanding of their energy consumption and identify opportunities for reducing their carbon footprint.

“AWS and Cappgemini provide the foundation that energy companies require to transform complex business and operational systems to accelerate the transition to a more sustainable energy future”

Robert Bekkering, global senior partner development manager, Cappgemini Energy/Utilities & Life Sciences, AWS

Inclusion refers to the need to create a more equitable and just society. In the energy/oil and gas industry, this means ensuring that all stakeholders, including communities, workers and suppliers, are included in decision-making processes and benefit from the industry’s activities. Digital transformation can help achieve inclusion by providing greater transparency and engagement.

Collaboration is especially important because it involves many different stakeholders, including governments, regulators, suppliers and

customers. Digital transformation can help facilitate collaboration by enabling better communication and data sharing.

Decarbonisation of oil and gas field operations with Open Cascade

Some 70-95% of the greenhouse emissions any oil and gas (O&G) operator produces comes from the oil and gas field production activities.

O&G companies have the inherent task of maintaining and/or increasing production of their oil and gas fields, so combining this with reducing emissions presents inevitable challenges from both a planning and a field operations perspective (see box, below).

These challenges can be addressed by using the Accelerating Decarbonization through O&G Fields Integrated Asset Management – Field Digital Twins solution from AWS and Capgemini.

This solution uses an open and flexible architecture developed by AWS and Capgemini Open Cascade to build a field-level digital twin specifically customised to support asset teams with the information needed to run their operation and optimise production, while developing solid steps to decarbonisation.

The concept is a field-level digital twin – a platform that brings to the table the best AWS technology and Capgemini’s Open Cascade with the objective to manage oil and gas field operations in a holistic way, responding to the very particular characteristics of each field and type of operation.

The integrated architecture enables data flows from the field, wells and surface infrastructure as well as information and insights from the engineering asset management teams, to work together to manage the field in a holistic way through the field-level digital twin for informed decision-making.

DECARBONISATION CHALLENGES FOR FIELD DEVELOPMENT PLANNING AND OPERATION: PART 1

Field development planning

The objective here is to define the location of the reserves and how to reach and extract them. Issues include:

- Petrotechnical issues such as high uncertainties and risk associated to the reservoir and basin with field characteristics such as low porosity, tight formations, aquifers and water management, or natural fractures;
- Issues of the type of basin exploited such as conventional versus unconventional, reserves estimation, financial models;
- Different multidisciplinary physics models such as drilling, completions, geosciences, production, reserves management that over time have been built, stored and used in siloed specialised software products, databases and teams;
- Perform manual workflows to increase production such as well testing, well integrity, artificial lift equipment optimisation, fluid injection simulations;
- Extreme need every day for lots of quick operative decisions that typically have a high impact on economic value and risks, affecting personnel, financial, geological and reservoir operations.

The first software functionality implemented will focus on well-by-well management and automating workflows such as well test and well integrity. The focus then moves to risk management, and finally capabilities to stream data from sensors and telemetry in the well and the well head, to optimise equipment including notifications, alarms and predictive failure. The objective in the future is to be able to update reservoir models with production data. All of this will be exactly customised and tailored to the specific needs of the field, reservoir and its technology required, based on the specific challenges they are facing.

To start the journey, AWS and Capgemini will perform a digital maturity assessment of the oil and gas field to understand the level of automation in existing workflows, covering areas

such as status of Scada systems; sensors on the wellheads and bottom hole conditions; virtual fluid metering; whether using cloud infrastructure or on premise; plus databases and use of third-party software platforms. This allows operators to anticipate issues and take proactive steps to prevent them before they occur, which can reduce downtime, increase efficiency and therefore reduce emissions.

One of the key features of Open Cascade is its ability to optimise production for clean hydrocarbons. The platform uses advanced modelling and simulation tools to optimise production while minimising greenhouse gas emissions and other environmental impacts.

“The umbrella of an integrated asset management digital twin includes decarbonisation as

DECARBONISATION CHALLENGES FOR FIELD DEVELOPMENT PLANNING AND OPERATIONS: PART 2

Field operation

Technology challenges depend on the type of operation, for example:

- **Conventional reservoirs, onshore fields operations:** normally mature/brown fields with more than 15 years of operation and production, with old oilfield technology and lack of basic infrastructure. In such circumstances, assets may not support the required new instrumentation and automation. Assets should have enough hydrocarbon production life to warrant the cost of retrofitting infrastructure with well site controls and automation.
- **Conventional reservoirs, offshore fields operations:** normally mature fields but can include initial phases of production. Typically, high hydrocarbon volume fields with considerable infrastructure for the initial capital expenditure. Digital technology maturity is highly correlated with the field lifecycle stage and the geography located. Important instrumentation and equipment installed on the surface systems, subsea wellheads and downhole, with relative isolation from support groups on land (such as the asset management office) and poor connectivity. This causes a time lag to get real-time data on the onshore support centres.
- **Unconventional reservoirs, onshore fields operations:** operation is like a factory doing drilling, completions and fracking at scale, requires precise, on-time and sufficient amounts of materials, equipment and personnel. Supply chain challenges. Production more data than physics models driven. Newer technology, sensors, optic fibre, telemetry, valves, flowmeters, chokes installed, more digital oilfield infrastructure can be applied economically.



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we know this is one of the main strategic objectives companies embrace in their journey to net zero and sustainable operations,” says Lidia Ramirez Garcia Cano, principal transformation subject matter expert for energy, oil and gas, at Capgemini.

“One of the most important KPIs is the monitoring and reduction of kilograms of CO₂ emitted per barrel of oil equivalent produced – deep correlated with the integration of reservoir conditions while producing, as well as operational and production efficiencies. Due to the multivariable complex system, there is no ‘one solution fits all’. Each reservoir, field, operation and company will face different challenges to achieve these objectives, hence our flexible and integrated architecture. The same happens with reducing flaring intensity, methane management and for unconvensionals, water and spill management.”

A foundation for sustainable transformation

To achieve sustainability objectives, it’s crucial to ensure that all stakeholders are included in the decision-making process. This can involve developing close partnerships with clients to

gain insight into their specific needs and preferences and involving clients in the co-creation of sustainable solutions.

AWS and Capgemini Open Cascade can help to sustainably optimise production of hydrocarbons, remove the complexity of managing an oil field by managing it holistically, while supporting strategic decarbonisation objectives.

“AWS and Capgemini provide the foundation that energy companies require to transform complex business and operational systems to accelerate the transition to a more sustainable energy future,” says Robert Bekkering, global senior partner development manager, Capgemini Energy/Utilities & Life Sciences, at AWS.

“AWS has the broadest and deepest cloud platform and industry solutions that energy companies require to revamp legacy operations to be less carbon-intensive and accelerate the development of new renewable energy businesses and business models.”

Through the use of sustainable production optimisation solutions, oil and gas companies will increase efficiency, reduce costs and minimise environmental impact.