The Digital Oil and Gas Companies
Unlocking New Business Value with Intelligent Technology
“Market conditions continue to create uncertainty in the oil and gas industry. Energy companies have survived these oil price fluctuations by focusing on being lean. They are rigorously eliminating waste. They are managing by exception. They are focusing on core skills and outsourcing commodity tasks. Energy companies are optimizing production and throughput of existing assets. These lean efforts innovate across the value chain and leverage innovative technologies. Machine learning, the IoT, and advanced analytics offer unparalleled ability to extract, analyze, and act upon operational data.”

Benjamin Beberness
Global Vice President
Oil and Gas Business Solutions
SAP SE
Volatile Energy Prices, Uncertain Geopolitics and Aging Workforce Drives Business Innovation

Leading energy companies use market dynamics to create and capture new business opportunities.

Volatile market
Oil price has recovered after a severe price drop from 2012 to 2015. More volatility is expected based on geopolitics and supply and demand.

Energy companies have diversified their investment portfolio and sold off unprofitable assets to reduce debt and minimize risk exposure. They also improve agility by creating scalable processes and systems through automation, artificial intelligence, machine learning, and a connected ecosystem.

Uncertain geopolitical situation
Unpredictable political situations with OPEC, Russia, and China can dramatically affect the oil and gas world supply and price.

Energy companies eliminate redundancies and lag in execution times to improve productivity and reduce capital and inventories to be able to respond more quickly to market changes. Technology platforms are used to enable rapid connections to external parties, flexible scale, and innovation.

Aging workforce
Energy is fundamental for our 21st-century lifestyle and we need to find new ways to sustainably satisfy the rapidly growing need for energy.

Energy companies need to replace an aging workforce while maintaining their intellectual property, and attract a different set of new skills to address the digital era.

Fast growth in renewables
The faster-than-expected growth in renewable fuels is creating added margin pressure on traditional business models.

Energy companies are starting to invest in renewables to augment traditional oil and gas (for example, Total is the second-largest solar power company) and taking a growing interest in new business models, such as energy as a service.

Leading energy companies use digital technologies to create the intelligent enterprise that enables them to focus on:

- **Costs** – The elimination of redundancies and lag in execution times will dramatically improve productivity and reduce capital and inventories as a result of improved collaboration and sharing within the network.
- **Diversity** – The modularity of the network makes it easier to apply existing competencies in a more diverse portfolio of energy; for example, applying offshore production capabilities to underwater mining.
- **Outcomes** – Development of more outcome-focused business models – for example, new partnerships and market entries into retail, banking, and consumer goods – enables delivery of those outcomes as transportation and heat, instead of just input fuel.
Innovative Energy Companies Use the Digital Energy Network to Transform Their Business

Access to resources and capital is no longer enough to sustain competitive advantage in the digital economy, which is driving the development of new business models that increasingly rely on digital technologies and information to compete.

The primary strategies of cost control, diversification, and focus on outcome are being applied to the business model types listed below for participants across the digital energy network. The network’s adaptability, flexibility, and these emerging models will drive energy organizations’ digital transformation.

**Energy outcome providers**
Consumers are more empowered than ever and are demanding simplicity and service quality. Energy providers are extending “beyond the barrel” to master consumer energy usage analytics to offer services that optimize delivery of transportation, heating and cooling, and power. Examples include delivering the outcomes of transportation, climate control, or a powered device – not just the traditional fuel inputs.

**Products and service digitalization**
Logistics providers are disrupting the entire value chain by managing physical deliveries across the network, often without owning or operating any of the necessary inventory or assets or hiring the necessary employees. For example, SAP® Asset Intelligence Network creates “digital twins” of physical assets and shares business models among OEMs, service providers, and operators.

**Competing as an ecosystem**
In an increasingly volatile energy market with a broadening range of asset types and energy sources, the success of energy operators is largely determined by three variables: safety, cost, and agility. Operators are pushing the boundaries of augmented reality and use of robotics in operations activities to improve safety and productivity, and seamlessly sharing data and calling on ecosystem partners to work together in ensuring production, profitability, and safety targets are met.

**Digital platform**
Continued investment and ingenuity is expanding the energy network infrastructure. Digital leaders are delivering operationally ready assets, often on a performance or revenue-share basis, by using the power of supercomputing for more accurate exploration and effective asset design and constructability. Others are using a networked platform for collaborative project management that will orchestrate work and logistics across multiple trades and disciplines.

In addition, business optimization and extending the value of key processes continue to be key priorities for innovative energy companies to simplify and reimagine their business and free up resources to invest in transformative programs.

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One-third
Of the top 20 market-share leaders in most industries will be significantly disrupted by new competitors.

>10:1
Ratio of devices that operate autonomously today, compared to those that have human interfaces

15%
Higher productivity for connected workers by 2020 by digitalizing assets and humans

US$95 billion
To fuel retailers from personalized offers as energy outcome providers simplify service delivery and quality

Our Point of View: To Achieve These Strategic Priorities, Leading Energy Companies Are Becoming Intelligent Enterprises

The intelligent enterprise enables employees to focus on higher-value outcomes and to invent new business models and revenue streams.

By applying intelligent technologies such as the Internet of Things (IoT), artificial intelligence (AI), machine learning, and advanced analytics, leading energy companies transform into event-driven businesses. Event-driven businesses automate repetitive tasks, enable employees to focus on higher-value tasks, and allow the invention of new business models and revenue streams by monetizing data-driven capabilities and applying core competencies in new ways.

Optimize and extend the value of current processes

Transform with next-generation business processes
SAP Enables Energy Companies to Become Intelligent Enterprises

SAP helps oil and gas companies transform into intelligent enterprises through integrated business applications that use intelligent technologies and can be extended on SAP® Cloud Platform. This enables next-generation business processes to deliver breakthrough business value on our customers’ journeys to becoming intelligent enterprises.

Intelligent Suite

The set of applications provides the business capabilities that oil and gas product companies need to run their business. End-to-end business processes span multiple applications, so processes and data must be integrated for automation, a seamless user experience, fast adoption, and ease of operations.

Intelligent Technologies

Several innovative technologies have matured to practical use:

- The Internet of Things makes business applications interact with the physical world.
- Big Data makes large data sets accessible for advanced analytics and intelligence.
- Machine learning and artificial intelligence automate repetitive processes and learn from human exception handling and decision-making.
- Advanced analytics find data patterns to support decisions and predict the future.
- Blockchain distributes collaborative processes across the entire value network.
- Data intelligence finds new value in data assets for new business models.

Digital Platform

The digital platform, which is powered by SAP HANA®, extends intelligent end-to-end processes and connects to data sources:

- Cloud platform that allows customers and partners to extend their intelligent suite to run additional business processes
- Data management to handle and organize data, a key asset of the intelligent enterprise
SAP Leonardo

SAP Leonardo brings the power of intelligent technology to your platform and applications to streamline existing workloads, reveal optimal decisions, maximize revenue and profits, improve customer satisfaction, and capitalize on digitally transformed business models.

In addition, companies can use SAP Leonardo services, delivered by world-class innovators that combine industry and emerging technology expertise, to help drive innovation and business impact at scale.
SAP Leonardo: Intelligent Technologies Optimize, Extend, and Transform the Business

Oil and gas (O&G) intelligent scenarios
SAP Leonardo capabilities are embedded in the business core and industry applications to optimize and extend business processes. Companies can also use them together with innovation services to build and assemble next-generation business processes. For energy companies, we support more than 20 intelligent scenarios to optimize, extend, and transform their business. Below are a few highlighted ones that will be further explained on subsequent pages.

- Cash application
- Inventory optimization
- Talent exchange
- Resume matching
- Asset manager for field operations
- Wellhead production optimization
- Asset intelligence network
- Intelligent Fuel Management
- O&G service and assets
- Mining fleet operations
- Innovation factory
- Equipment and material easy returns
SAP Leonardo: Applications Optimize Business Processes

Optimizing business processes results in achieving the same business outcome more efficiently and reliably. We begin with scrutinizing current practices: What can be automated using machine learning? How can we make processes aware of the real world by connecting them to the things around them? How do we give people the right analytical tools to make sense of vast amounts of data and to handle exceptions?

<table>
<thead>
<tr>
<th>Cash application</th>
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<th>Talent exchange</th>
<th>Resume matching</th>
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<tbody>
<tr>
<td>Errors in accounts receivables due to manual data entry and high volume of invoices received.</td>
<td>Inventory inaccuracies that cause delays for operations; difficulty with identification of spare parts and their location that causes delays to support field operations.</td>
<td>Difficulty managing open positions on projects with internal employee skill sets, as well as external candidates applying for available open positions.</td>
<td>Difficulty identifying and qualifying people for open jobs, which is labor intensive, time-consuming, and costly.</td>
<td>Inability of workers to access work orders, equipment performance data, safety processes, or receive notifications remotely.</td>
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</table>

Cash application functionality uses machine learning to speed up postprocessing time for electronic bank statements, reduces errors by automating data entry and matching, and increases throughput for financial postings to complete transactions.

Inventory optimization functionality enables accurate tracking of inventory and identifying parts availability, location, logistics for field delivery, with information to support equipment repair, startup, and operation. It updates inventory as parts are used.

Talent exchange functionality facilitates the movement of employees between assignments. It also identifies employees who are available for new assignments, along with positions that need to be filled to support global staffing needs.

Resume matching functionality uses machine learning to identify candidates to the skills and education for open positions. It mitigates personal bias of recruiters so qualified candidates are not overlooked.

Asset manager for field operations functionality improves remote worker productivity and safety, enabling them with equipment data, notifications and material information to complete work safely via any mobile device.

- Reduces DSO and cycle time
- Improves data quality through machine learning recognition
- Reduces time to service
- Ensures inventory accuracy, which reduces costs
- Reduces cycle time for staff reassignment
- Increases retention due to higher job satisfaction
- Enables rapid identification of qualified candidates
- Increases productivity of recruiting staff
- Reduces time to service
- Reduces equipment downtime

“Artificial Intelligence is the new buzzword in the industry. SAP has the capability to leverage AI in new solutions to move utilities toward digital transformation.”
– Ali Emamjomeh, Enterprise Architect, Innogy

**BASEF** is using machine learning to increase efficiency in its finance organization. 94% of payments now get automatched to invoices.

**ExxonMobil** leverages its Talent Exchange solution to place the right people with the right skills for the right position at the right time. The solution is used by over 25,000 employees.

“I have no doubt that we will look back and wonder how we ever conducted business without this type of tool.”
Margaret Mattix, Talent Manager

**Aegea Saneamento** is improving water supply with machine learning and IoT by increasing the efficiency and decreasing the water loss for each pump in the system. Aegea is now able to predict critical situations, suggest how to solve them, and drive simulations to improve decision-making.

**HMEL** enabled dynamic reporting and improved decision-making with correct and timely availability of data insights by integrating operational and information technologies.
SAP Leonardo: Capabilities and Services Extend Current Processes to Capture New Sources of Value

Extending business processes aims at generating more value and new outcomes. Begin by challenging the status quo: Are we doing the right things in managing assets or our portfolio? Innovators use digital technology to reimagine business processes to create new value. We gain reduced equipment downtime because it has been predicted and prevented and materials that are replenished just-in-time through a network of suppliers supporting drilling operations.

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<tr>
<th>O&amp;G service and assets</th>
<th>Wellhead production optimization</th>
<th>Asset intelligence network</th>
<th>Mining fleet operations</th>
<th>Intelligent Fuel Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty knowing which assets to fix when there is limited visibility of their performance; workers who need the right diagnosis, location and insight to fix O&amp;G equipment</td>
<td>Siloed and field data sources that is not easily integrated to optimize drilling or production processes</td>
<td>Costly asset downtime due to wrong parts, procedures, diagnosis, or workers assigned for the repair</td>
<td>Difficulty maintaining the fleet to support field operations and knowing which vehicle to fix, scheduling the repair, and arranging for parts delivery, which takes time</td>
<td>Difficulty aligning fuel orders with logistics, delivery and reconciliation and manual processes that lead to inaccurate orders and system of record</td>
</tr>
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</table>

SAP Leonardo for Oil and Gas, service and assets option, uses sensors, predictive maintenance, machine learning, and integration of data sources (data historian, SCADA, and notifications) to provide workers with insight into equipment performance to optimize maintenance and repair processes.

Wellhead optimization functionality uses sensors, condition monitoring and machine learning to intelligently identify drilling progress (downhole) or wellheads falling below expected production levels to quickly resolve any issues.

SAP Asset Intelligence Network enables content delivery from suppliers to maximize asset maintenance processes while reducing nonproductive time (NPT). It improves operating efficiency, including reduction of downtime and search for equipment information.

SAP Leonardo for Mining, fleet operations option, tracks vehicle performance to optimize utilization and reduce maintenance costs. It also tracks the vehicle, determines the shortest routing to repair locations, and confirms service parts and personnel are present to make the repair, thereby minimizing downtime.

Intelligent Fuel Management functionality enables visibility for the airline, the ground, and fueling crews. Real-time data routes fuel trucks to minimize airline time at the gate. Streamlined processes remove duplication and improve orders and transaction efficiency, reducing errors.

- Reduces cost of maintenance
- Reduces equipment downtime
- Reduces time to service
- Reduces maintenance costs
- Reduces order entry errors through automation
- Faster time to service
- Increases production yield
- Increases enterprise profitability
- Increases uptime and utilization

Pacific Drilling S.A. leverages SAP Edge Services to be fully functional in “disconnected” mode on its drilling rigs and to optimize material and supply replenishment, work execution, and project visibility.

Devon Energy uses wellhead production optimization and IoT technology to gather information from surface and downhole operations to improve equipment performance and reduce overall costs.

O&G companies use SAP Asset Intelligence Network to integrate equipment information and to ensure data consistency and availability for workers maintaining assets. They also use it to collaborate with suppliers, reducing design cycle time for new parts.

Vantage Drilling leverages edge services and machine learning to maintain visibility to global drilling operations to replenish supply, materials, MRO and people for offshore operations.

Shell uses Intelligent Fuel Management functions to process delivery tickets on a mobile tablet, using an electronic proof-of-delivery solution. The solution allocates vehicles and resources based on flight schedules, and maintains live tank feeds to monitor fuel inventory before reordering.

SAP Leonardo: Intelligent Technologies and Innovation
Transform the Oil and Gas Value Chain and Business Models

Transforming the business starts with ideas to conquer new markets with current products or deliver new value on your home turf. It often goes along with a renewed view of who the ultimate customer is and what kind of value they really need.

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<th>Innovation factory</th>
<th>Equipment and material easy returns</th>
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<tr>
<td>Inability to integrate data silos to improve decision-making on oil and gas drilling prospects and production planning</td>
<td>Difficulty processing returns and inaccurate and mismatched descriptions with parts reassembled in the field, which is a highly manual process</td>
</tr>
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</table>

Innovation factory aggregates siloed data, integrating important data sources to improve visibility using analytics and machine learning to look for trends to improve operations and increase profitability.

Equipment and material easy returns functionality enables operators to track inbound returns (using auto-ID and GPS) to the warehouse, identify containers (auto-ID), confirm received materials, and automatically process documents, inventory, and financials to streamline all return processes.

- Reduced data errors, creating one version of the truth to drive decisions
- Optimized equipment performance, reducing downtime
- Lower cost of capital deployed
- Reduced downtime, with quick turnaround of equipment for next job
SAP Leonardo: Transformational Scenario
The Innovation Factory

Transform maintenance to improve equipment performance and uptime with real-time insight

Upstream oil and gas companies have always had a focus on operations, as asset or equipment downtime, whether expected or not, is very costly. There are many examples where literally millions of dollars a day are spent due to this, including downtime, delays in parts, or lack of available personnel to fix the problem.

One such example is the **electrical submersible pump**, typically called an ESP. It is an efficient and reliable artificial-lift method for lifting moderate to high volumes of fluids from wellbores. **If this pump fails, it can cause a loss of production from the well, resulting in financial losses of tens of thousands of dollars per day, and the replacement of these pumps can cost up to $1 million.** Some companies may have up to 5,000 of these pumps across their oil fields. These pumps are just one type of such equipment: when a rig is down, costs also soar. Companies make every effort to get equipment failures fixed as soon as possible to try and keep costs down.

**Today, engineers attempt to maximize equipment uptime** by analyzing relevant operational data and predicting equipment behavior. Unfortunately, however, these data sources are often siloed, not integrated, and don’t use a single source of “the truth,” making comparisons and predictions sketchy at best.

In order to transform their operations, **companies need to develop data-driven models that improve over time, aggregating data from operational systems to enable business insights** to improve decision-making. This provides a real-time view of their operations, transforming the decision-making process, and enabling the improvement of equipment and asset uptime throughout.

**Cost to operations**
- Breakdowns: ~$1 million to replace an ESP
- Average downtime: ~21 days (remote operations)
- Number of wells: Hundreds to thousands

* Source: SAP IVE Benchmarking Study, for an O&G Customer, 2017
SAP and Customers Jointly Enable Energy Companies’ Transformation Journey

SAP has developed a proven innovation methodology, working closely with customers to leverage technology to create impactful innovations to transform their enterprise. This co-innovation approach is designed to deliver faster innovation with less risk by combining the expertise of customers and SAP. An example of this is the Innovation Factory initiative SAP ran with Marathon Oil company.

Marathon Oil and SAP co-innovate to deliver upstream production optimization

Many conditions in upstream production can cause costly production downfalls and downtime. These conditions should be identified, predicted, and prevented to avoid costly asset downtime.

Marathon Oil had one such condition: paraffin build-up, affecting both rod pump and gas lift wells in Eagle Ford. The paraffin can plug flowlines, gas lift valves, or even the wellbore, and can dramatically reduce well performance. Early detection can reduce, or even preempt, well downtime. Current rule-based alerts are limited in their effectiveness, and don’t learn over time.

Co-innovating with SAP, Marathon Oil sought to transform their operations by developing a data-driven model that “flags” paraffin buildup and improves over time. The model aggregates data from business insights with real-time operational data (for example, historian data) to provide a real-time view of the operations, transforming the decision-making process.

Benefits

- More production and less loss due to paraffin buildup
- Improved staff efficiency and eliminated redundancies and automated manual processes
- Constantly improving model accuracy
- Scalability to equipment and other assets

"With the reduced commodity prices, it’s critical for E&Ps to operate in a more efficient way. By identifying issues, prioritizing, and understanding the root cause of an impending event, we can reduce asset downtime and get the best return on investment."

Varun Garg, Marathon Oil, at the Best Practices for Oil and Gas conference, October 2017

View this video to find out more on how E.ON, in collaboration with services from SAP, develops innovative solutions to face the changing market of tomorrow.
How to Get Started with SAP Leonardo

Whether you’re still exploring new ideas or have defined one idea in detail already, SAP Leonardo brings together world-class innovators, industry and emerging technology expertise, proven use cases, and design thinking methods to help you optimize your business and drive innovation and impact at scale – faster and with less risk.

SAP takes a holistic approach to innovation. Because digital transformation isn’t just about installing the latest technology, we also address the readiness to receive a new idea. From human capital to infrastructure, we bring best business practices across your organization to improve communication, plan for employee training, review technical and regulatory feasibility, and consider other cross-functional needs to drive change and truly scale your innovation.
SAP Is the Innovation Partner for Oil and Gas Companies

Ten-year innovation vision
Deliver fully intelligent business solutions and networks that span across company boundaries and promote purpose-driven businesses. These solutions will be the most empathic symbiosis between machine intelligence and human ingenuity.

- Self-running enterprise systems
- Self-organizing business ecosystems
- New markets and business models

Comprehensive industry coverage
SAP enables the comprehensive coverage of the complete oil and gas value chain across the enterprise. With its clear industry road map, SAP is the partner of choice for the oil and gas industry.

- More than 3,300 oil and gas (O&G) companies in 118 countries are innovating with SAP solutions
- 87% of O&G companies in the Forbes Global 2000 are SAP customers
- SAP customers in the oil and gas industry produce more than 78 million barrels of oil each day

Proven services offering
By bringing together world-class innovators, industry and emerging technology expertise, proven use cases, and design thinking methods, we help oil and gas companies develop innovations that deliver impact at scale.

- Use proven methodologies to drive innovation, from reimagining customer experiences to enhancing operations
- Fuel your innovation through a managed innovation ecosystem from SAP
- Build your own innovation capability and culture

SAP delvers support for the intelligent enterprise for energy companies – providing integrated business applications that use intelligent technologies and can be extended on SAP Cloud Platform to deliver breakthrough business value.