sustainable solutions for the oil and gas industry
water, waste and operational efficiency

ready for the resource revolution
TRANSFORMING CHALLENGES INTO OPPORTUNITIES

adapted water & waste services for the exploration & production industry

- field productivity.
- risk control.
- environmental performance.
- local content.

Every day around the world customers trust our highly skilled and experienced professionals to deliver proven technologies that meet their production challenges. We provide safe and efficient solutions for oil treatment, gas processing, water and waste resources management. Both onshore and offshore, our full life-cycle solutions – from consulting to end-of-life operations – adapt to your fields’ specific requirements to make SUEZ your high-performance partner.

How can you ensure continuity of operations?

How can you improve environmental integration?

How can you optimize production efficiency?

How can you ensure continuity of operations?

By prioritizing safety with tried-and-tested solutions for emergencies and hazardous waste treatment, and by improving operational efficiency with smart maintenance services.

To optimize day-to-day membrane management, SUEZ developed Memboard, a decision-support software for membrane fleets, that helps in establishing a targeted renewal strategy and optimizes operating costs.

By using dedicated consulting services and tailor-made water and waste treatment solutions to comply with regulations, and ensure that production sites are fully integrated into their natural and social environments.

Actimar, SUEZ’s oceanographic consultancy, realizes metocean studies and long-term impact assessments to help offshore oil platform installations be optimally adapted to their environment.

By increasing recovery rates with innovative water-treatment technologies, or reducing costs with solutions that improve resource reuse and asset preservation.

In Oman, SUEZ’s proven deoiling cyclone technology installed on a production site, reduced oil-in-water levels from 3,000 to 30 ppm(v). Complete with upstream desanders, the treatment line enabled the reuse of produced water for high-pressure reinjection into the well, maintaining field productivity and closing the produced-water loop.

97 million bbl/d
the global oil production increase projected by IEA to meet growing demand in 2035.

3 barrels
the average quantity of produced water to treat and recycle for every barrel of oil extracted.

2.4%
the annual growth of natural gas’s share of the global energy mix until 2018.
our upstream expertise means you benefit from:

- International presence
- Our safety culture
- In-depth expertise and experience in the upstream industry
- Highly skilled professionals
- Reliable, field-tested technology
- Tailor-made solutions

operating in 70 countries, on 5 continents

they trust us

ADNOC  AERA ENERGY  ARAMCO  BHP BILLITON  BLACK & VEATCH  BP  BUMI ARMADA  CENOVUS ENERGY  CHEVRON  CNOOC  CONOCOPHILLIPS  ENCANA  ENI  EXXONMOBIL  FLUOR  GAZPROM  HESS  HUSKY ENERGY  INPEX  KBR  MAUREL & PROM  McDermott  MDEc  NOVATEK  ORIGIN  PDVSA  PEMEX  PERTAMINA  PETROBRAS  PETRONAS  QATARGAS  RASGAS  SAIPEM  SANTOS  SHELL  SINOPEC  SONATRACH  TECHNIP  TOTAL  WOODSIDE
At SUEZ we believe that the best answers are found by working in close collaboration with you, our customers. Around the world our experienced staff analyze your needs to create tailor-made solutions that meet your requirements.

As field characteristics change over time, we anticipate the evolution of your production needs through adaptable solutions. Using reliable technologies and modular designs, we develop evolving equipments to build long-term relationships.
increasing performance by understanding your needs
our expertise for your processes

1. Wellhead desander
2. Three-phase separation
3. Effluent treatment
4. Gas sweetening
5. Gas dehydration
6. Dew-point control
7. Desalting
8. Cyclones
9. Plate interception and flotation
10. Nutshell filtration
11. Ultrafiltration
12. Reverse osmosis
13. Sulfate removal
14. Mobile units
15. Ion exchange
16. Industrial and hazardous waste management
17. Soil remediation
18. Environmental consulting and resource performance
19. Flood risk management
20. Metocean forecasting
**SUEZ exploration and production offer sustainable solutions for the oil and gas industry**

### Improving production efficiency

**Higher productivity, lower costs.**
With solutions to increase oil and gas recovery, implement reuse systems and preserve your assets, SUEZ is your partner in strengthening your competitiveness.

<table>
<thead>
<tr>
<th>Improved recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ Hyper-spectral imagery</td>
</tr>
<tr>
<td>◆ Production of demineralized water for boiler feed, oil desalting and auxiliary utilities</td>
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<tr>
<td>◆ CO₂ separation / extraction from gas</td>
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<tr>
<td>◆ Treatment for steam injection</td>
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<tr>
<td>◆ Treatment for water injection</td>
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<tr>
<td>◆ Treatment of produced water for EOR steam</td>
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<tr>
<td>◆ Treatment of produced water for chemical EOR</td>
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<tr>
<td>◆ Hyper-spectral recovery</td>
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<thead>
<tr>
<th>Resource performance</th>
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<tbody>
<tr>
<td>◆ Water reuse and zero liquid discharge</td>
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<tr>
<td>◆ Gas treatment (sweetening and dehydration)</td>
</tr>
<tr>
<td>◆ Cable collection and recycling (copper, aluminium)</td>
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</tbody>
</table>

**Optimum OPEX and asset preservation**

- Outsourced operations and maintenance
- Mobile units leasing and renting
- Off-site effluent treatment service
- Expert management of membrane installations
- Corrosion protection
- Facilities and amenities design

### Securing operations

**Continuous production, improved results.**
Ensure uninterrupted production with reliable solutions to control risks or emergencies, and adapted maintenance services for optimal site management and operational efficiency.

<table>
<thead>
<tr>
<th>Ensuring safety</th>
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<tbody>
<tr>
<td>◆ Diagnosis of marine environment</td>
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<td>◆ Preventive safety reviews performance</td>
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<tr>
<td>◆ Emergency and spill contingency plans and intervention</td>
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<tr>
<td>◆ Flood risk management</td>
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<tr>
<td>◆ Safe cleaning, disposal and recycling of NORM waste or radioactive contamination</td>
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<tr>
<td>◆ Safe collection, recycling and disposal of hazardous waste and medical waste</td>
</tr>
<tr>
<td>◆ Removal of hazardous waste, asbestos, lead, insulation, radioactive sensors</td>
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<tr>
<td>◆ Explosives clearance</td>
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<table>
<thead>
<tr>
<th>Operational efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ Metocean forecasting</td>
</tr>
<tr>
<td>◆ Resource assessment &amp; management (water and power)</td>
</tr>
<tr>
<td>◆ Facility management of base camps</td>
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<tr>
<td>◆ Safe collection and disposal of domestic and non-hazardous waste</td>
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<tr>
<td>◆ High-pressure cleaning solutions and maintenance for operations</td>
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<tr>
<td>◆ Spare parts and dedicated equipment maintenance</td>
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<tr>
<td>◆ Smart and remote monitoring and controlling of operations</td>
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<tr>
<td>◆ Knowledge management and shared return on experience</td>
</tr>
<tr>
<td>◆ Compact and modular design of equipment</td>
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### Optimizing environmental performance

**Environmental and social integration.**
Because local integration is a key element of your business performance, SUEZ develops ranges of dedicated services for more sustainable activities.

<table>
<thead>
<tr>
<th>Regulatory compliance</th>
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<tbody>
<tr>
<td>◆ Environmental impact assessment</td>
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<tr>
<td>◆ Carbon footprint assessment</td>
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<tr>
<td>◆ Process monitoring and discharge control</td>
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<tr>
<td>◆ Energy and environmental indicators definition</td>
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<tr>
<td>◆ Support for energy and environmental certification</td>
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<table>
<thead>
<tr>
<th>Environmental protection</th>
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<tbody>
<tr>
<td>◆ Produced water and effluent treatment for discharge</td>
</tr>
<tr>
<td>◆ CO₂ reinjection to wellheads</td>
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<tr>
<td>◆ Mercury removal from gas</td>
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<tr>
<td>◆ Ballast water treatment</td>
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<tr>
<td>◆ Treatment of polluted soil and sand by bioremediation, thermal desorption and soil washing</td>
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<tr>
<td>◆ End of life clean-up of FPSO and FSO</td>
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<tr>
<td>◆ Offshore platform decommissioning</td>
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<tr>
<td>◆ Water footprint assessment</td>
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<tr>
<td>◆ Oil drift prediction and oil spills characterization</td>
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<table>
<thead>
<tr>
<th>Social sustainability</th>
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</thead>
<tbody>
<tr>
<td>◆ Knowledge transfer to local populations</td>
</tr>
<tr>
<td>◆ Local content development</td>
</tr>
<tr>
<td>◆ Engineering of base camps &amp; surrounding living areas</td>
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breakthrough innovation, real-world applications

CYCLONIXX®
Cleaner water, high efficiency
SUEZ’s CYCLONIXX cyclones are a robust and reliable method of separating solids and oil from produced water and multiphase streams. The compact, pressure-driven separators efficiently remove oil and abrasive solids to improve package downtime and environmental performance.

GLYNOXX®
Reusing gas, cutting waste
Easy to install or to retrofit, GLYNOXX virtually eliminates the need for external gas consumption in TEG gas-dehydration procedures. The closed-loop process recycles stripping gas, reconditions it and returns it to the stripping column under pressure. This significantly decreases consumption of saleable gas, while reducing plant emissions.

Advanced produced-water treatment
Optimal treatment for specific use
Our Oil & Gas lab, based at CIRSEE, SUEZ’s expertise and research center, is developing new treatment processes to make contaminated produced water suitable for reuse or discharge to the environment. We create new solutions to remove and recover oil, and eliminate scale and salinity, while taking into account oil and gas facilities’ technical needs and constraints.

a full range of reliable technologies

Water / Seawater treatment
- Coarse filtration
- Pressure filtration
- Ultrafiltration
- Ion exchange
- Cartridge filtration
- Sulfate removal / nanofiltration
- Vacuum deaeration
- Reverse osmosis

Gas treatment
- Glycol dehydration
- Glycol regeneration
- Molecular-sieve dehydration
- Gas sweetening
- Dew-point control
- Fuel-gas treatment and metering
- Carbon capture

Produced-water / Effluent treatment
- Cyclones for desanding and deoiling
- High-rate clarification
- CPI / PPI
- API / DCI, including circular API
- Flotation systems, including DGF, DNF, DAF, GDF
- Deoiling sand filters
- Nutshell filters
- Ion exchange
- Ozoneation
- Advanced oxidation systems, such as ozone and H2O2
- GAC and anthracite filters
- Ultrafiltration
- Evaporation systems
- Biological treatment, such as MBBR, MBR and biofilters

Oil treatment
- Primary separation
- Free-water knock-out drums
- Dehydrators
- Coalescers
- Heater treaters
- Electrostatic desalters
- Degassers

Waste treatment
- Thermal desorption
- Bio treatment
- High-pressure cleaning system
- Landfilling
- Incineration
Because the quality of water and gas is essential for enhanced oil-recovery processes, SUEZ helps you optimize your treatment line to fit your production requirements. Based on reliable, proven technology, our treatment solutions enable you to achieve perfect water or gas composition, and so improve field productivity.

For each project, we analyze your needs and design tailor-made equipment. As water reuse has become a key issue for production companies, SUEZ has developed innovative processes to close the produced-water loop for injection and EOR. Our wide range of filtration technologies removes suspended solids or chemicals to both reduce equipment corrosion and protect the environment.

EOR: perfect water quality for every use

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helping AL REYADAH sequester carbon
Abu Dhabi, United Arab Emirates

AL REYADAH, a joint venture between ADNOC, Abu Dhabi’s National Oil Company and MASDAR, a world-leading renewable energy company based in Abu Dhabi, embarked on an ambitious carbon capture and storage project. The company planned to treat 800,000 tonnes of CO₂, produced annually by a local iron smelter for high-pressure injection in enhanced oil recovery. Before the gas could be used, however, it needed its moisture content reduced, so AL REYADAH turned to SUEZ. We designed and manufactured a molecular-sieve dehydration unit to reduce the water content in the gas and prevent the formation of damaging corrosive liquids. The equipment, made mainly from stainless steel, was designed to resist impurities and corrosion, and so ensure continuous operations.

a Total decontamination success
Douala, Cameroon

After 25 years moored off the coast of Cameroon, Serepca FSO, an oil-storage barge, was decommissioned. But before being broken up, it needed to be completely decontaminated of a wide range of hazardous pollutants, such as PCBs, chemicals and gases. A number of factors, including the barge’s position 120 kms offshore, made it an extremely complicated undertaking that demanded high levels of teamwork, planning, logistics and an exemplary safety culture. Working alongside Total E&P’s teams, SUEZ began by identifying pollutants, before cleaning and removing them from the barge, sending them back to shore in Cameroon and then onto treatment facilities in Europe. The project was successfully completed in accordance with both the Basel Convention and HSE regulations, and with a zero accident rate, making Serepca a showpiece decontamination project for both SUEZ and Total.
At its Mangahewa gas field, Todd Energy needed to manage the increasing amount of erosion caused by sand particles extracted with natural gas, associated condensate and water. Using its over 35 years of experience in desander cyclone technology, SUEZ was commissioned to design custom wellhead desanding units. The new system, which is economical and fully automated, enables the removal of 98% of solids at pressures of up to 22.5MPaG. The compact units were also designed to be moved easily from wellhead to wellhead so that intermittent problems caused by solids could be handled quickly. To ensure compliance with environmental regulations, SUEZ also provides tailored sand-handling and washing packages.

external source-water and produced-water treatment for injection
Maurel & Prom, Onal Oil Field, Gabon

To improve recovery rates on its Onal oilfield in Gabon, Maurel & Prom needed water suitable for injection, so the oil company contacted SUEZ to provide the design and supply of water-treatment facilities. SUEZ developed and procured a system comprising two treatment plants without an intermediate EPC. One treatment line filters brackish well water for injection. The second removes oil and solid particulates from produced water, using plate separators, flotation, and oily water filters. Since the treated produced water flow by itself is insufficient to meet injection water requirements, the two treated waters are blended together before polishing on automated pre-coat filters. Started up in 2009, following recent extension of the plant by SUEZ, it can now produce up to 120,000 bwpd for injection.

injection water from seawater
Petrobras FPSO units, offshore, Brazil

Advances in offshore production technology have allowed access to deeper oil fields. This has led to an increasing number of Floating Production Storage and Offloading (FPSO) being deployed, especially in the offshore Brazilian fields operated by Petrobras. SUEZ was commissioned to provide seawater treatment systems for injection on six of Petrobras’ FPSO vessels.

To provide reliability and consistent water quality the treatment line also includes fine filtration and deaeration units. Finally, reverse-osmosis membrane systems were also supplied to produce desalinated water for the crude-oil desalters.

SUEZ profile and key figures

SUEZ, a worldwide leader in water and waste resources management

Our goal is to ensure the most rational, efficient and sustainable management of today’s and tomorrow’s resources: optimizing processes, securing new alternatives for water supply, protecting the environment and recovering value from waste and by-products.

Committed to sustainable development, SUEZ is a key partner for industries and cities to support them in making the most of their resources. Focusing on environment and economic performance, SUEZ provides solutions to manage the complete water and waste cycle—a core element of the circular economy.

- Objective: Ensure injection water quality from seawater treatment
- Measured benefits: Complete treatment line implemented to avoid injection well fouling

- Objective: Reduce sand accumulation and erosion of equipment
- Measured benefits: 98% of solids larger than 9 microns removed

- Objective: Treat blended external source water and produced water to meet injection water requirements.
- Measured benefits: Over 120,000 bwpd made ready for reinjection

- Objective: Increase production at SUEZ offshore FPSO units
- Measured benefits: Injection water volume increased by 30,000 bwpd

- Objective: Increase efficiency at SUEZ offshore FPSO units
- Measured benefits: Energy consumption reduced by 15%