Passing on finite resources and invaluable nature to the next generation.
Natural resources that sustain the wealth of our lives are oil and natural gas, which have accumulated deep under the ground over a span exceeding several millions of years, will no doubt continue to play a key role as one of the most important sources of energy in both the industrial and civil sectors.

The scene of oil and gas exploration is in the midst of a shift to regions that are home to a harsh natural environment, such as remote areas, deepwater and arctic seas.

Also, along with growing concern over global environmental problems, there is ever-increasing demand by society for aggressive initiatives geared towards the well-balanced exploitation of natural resources with a minimum environmental footprint.

At Japan Oil Engineering Company (JOE), our vision is to do our part for the international society as a trusted adviser with a broad perspective in order to pass on the limited resources and invaluable nature of today to the next generation. With this vision in mind and the over-50 years of professional experience and state-of-the-art technology at our disposal, we seek to provide swift and precise solutions to the various issues that our customers face in their business.
Providing services at every stage from Exploration to Production

Oil and gas field development activities are carried out from lease acquisition to exploration, development and production. JOE, providing services at every stage, offers total consulting services of oil and gas field development from exploration to production throughout the project.

1. **Lease Acquisition**
   
   To be completed.

2. **Exploration**
   
   At the exploration stage, for the purpose of oil and gas field discovery and reserves evaluation, we define the expected area using acquired data by seismic exploration. Then drilling test is conducted and we analyze a plenty of data acquired using well logging technologies.

3. **Development**
   
   When oil and gas is judged as commercially feasible based on oil and gas reserves evaluation, drilling of production wells is started to extract crude oil and natural gas from underground. Besides that, the operators design and construct onshore and offshore structures, crude oil and natural gas production processing facilities, storage facilities, and shipping facilities. Moreover, pipeline laying, drilling of the injectors and so forth required for actual operation are conducted.

4. **Production**
   
   After the commissioning of the production facilities, oil and gas are produced based on production plans and, new wells are drilled to increase ultimate recovery amount and IOE/EOR (Improved Oil Recovery and Enhanced Oil Recovery) method is applied to improve the recovery rate. When commercial production is not expected and then abandonment is required, an appropriate approach is applied under regulations in individual countries for environmentally sound decommissioning.

JOE provides consultation services for oil and natural gas field development from lease acquisition to exploration, development and production, and proposes an optimal plan for the development of oil and gas.
Reservoir Parameter Evaluation and In-place Estimation

JOE evaluates the reservoir parameters and hydrocarbon in place by applying the latest technologies and software.

Overview of the evaluation of hydrocarbon-in-place and reservoir parameters

JOE collects the information of the target mining areas and their peripherals, and analyzes them from the engineering point of view. And then, comprehensive assessment on the prospectivity of the mining area is conducted through evaluation of the geological and geophysical data, basin analysis data and the validity of the development plan. JOE evaluates various reservoir parameters and estimate petroleum-in-place deterministically or stochastically, which are based on a quick and reliable processing and analysis of various types of data. In doing so, JOE use the best state of art software available.

It is also possible to provide the economical evaluation and investment risk analysis service for the oil and gas exploration and development project. Our economical evaluation based on our wealth of experience, have received high praise from many customers in the accuracy and reliability.

Major items for evaluation

- Well log analysis
- Characteristics evaluation of reservoir rock
- Reservoir fluid analysis
- Hydrocarbon in-place estimation

Rich experience in the field from projects in various countries and regions

Reservoir Characterization and Modeling

JOE constructs a precise and detailed 3D geological model through the analysis of geological, geophysical and reservoir engineering data, and builds an appropriate reservoir model for the highly-reliable reservoir simulation.

Overview of Reservoir Characterization

It is possible to construct a highly reliable reservoir model which reflects with great accuracy the information obtained from seismic data, well logging data, core data, well test data, production data and geological interpretation through a "geostatistical methods".

Examples of reservoir modeling

- Rock typing
- Geostatistical modeling
- Up-scaling

Providing a reservoir modeling for the efficient and accurate reservoir simulation

Reservoir Simulation

JOE provides useful information to establish the development planning of clients through a variety of reservoir simulations.

Accommodate various types of reservoir simulations

JOE has continued conducting its own research on numerical analysis method in the oil and gas reservoir engineering field for over 50 years. With such experience and track record, JOE can perform a variety of reservoir simulations related to petroleum reservoir engineering to make use of our experience and track record.

Examples of numerical simulations

- CCS (CO2 capture & storage) simulation
- Methane hydrate production simulation
- Natural gas underground storage simulation
- Oilfield Cuttings re-injection simulation

IOR (Improved Oil Recovery) Engineering

JOE supports the resolution of the various problems encountered in applying IOR technologies.

Support the challenges towards the IOR application

JOE has the latest technology, knowledge and know-how accumulated through various reservoir engineering research and simulator development related to IOR, such as miscible flooding, chemical flooding and thermal flooding.

We clarify and resolve the technical issues encountered in applying IOR technologies.

Evaluation, design and research necessary to apply IOR

- Screening of IOR applicability
- Reservoir evaluation of the IOR target reservoir
- Future reservoir performance prediction when applying IOR (Numerical simulation study)
- Design of an IOR pilot project
- Feasibility study and planning of IOR application project
Research and Development

With respect to research and development on resources and the environment, JOE is the technical supporter with the reservoir engineering point of view.

Widespread application of the oil and natural gas development technology

JOE has been involved in research and development of advanced technologies by applying the oil and natural gas development related technology and has developed various types of reservoir simulators. Taking advantage of our experience, we support the development of “numerical tool” to evaluate the physical and chemical phenomenon which is not considered in conventional software. In addition, JOE also supports the development of “numerical simulator” for carrying out the production forecast of the new resources (methane hydrate, etc.) in accordance with the client’s needs. Furthermore, JOE has abundant study experience for the “environment-friendly technology,” such as CCS (Carbon Dioxide Capture and Storage). For a variety of research and development related to underground fluid behavior, JOE provides a technical assistance from the petroleum reservoir engineering point of view.

Methane hydrate development technology

Methane hydrate is a low-temperature ice substance in which methane molecule is trapped in a cage-like structure constructed by the water molecules under low temperature and high pressure. It has been attracting attention as the next generation of energy, since it can be expected stable endowment under the seabed around Japan, and the emissions of carbon dioxide is lesser and clean at the time of combustion. JOE has played a role in the development of “numerical simulator” to predict the decomposition and production behavior of methane hydrate in the field scale. Also, JOE has been active in various scenes in methane hydrate research and development including reservoir simulation and reservoir modeling for the world’s first offshore methane hydrate production test off the coast of Japan.

CO₂ capture and storage

Now that global warming is becoming a serious problem, a variety of efforts to reduce air emission of carbon dioxide have been made in many parts of the world. As one of the promising solutions to the problem, CCS (CO₂ Capture and Storage) has received a lot of attention recently, in which carbon dioxide is injected into underground geological formations. JOE analyzes the behavior of CO₂ injected into geological formations by reservoir simulator to investigate the stability of stored CO₂ over a long period of time. For example, JOE simulates CO₂ migration in the reservoir, dissolution in the formation water, and the well placements to suppress the pressure rise which CO₂ injection causes. In addition, CO₂ is precipitated as carbonate minerals by reacting with some types of rock, which enable stable storage over tens of thousands years. However, flow simulation including this series reactions takes a very long computation time, and also has many difficulties in the convergence of the calculation. Therefore, it can be considered as an advanced simulation. JOE has a lot of experience in such simulations, and is providing consultation services related to such problems. The optimal well placements and well controls can achieve more stable and efficient CO₂ storage. To make highly reliable assessments for such optimal problems, JOE applies some optimization algorithms to the simulations.

Training Services

JOE provides education and training services about oil and gas field development technologies for all technical engineers.

Our training services

JOE’s training programs aim to share and transfer the knowledge and know-how we accumulated through domestic and international studies on reservoirs and Research and Development on the latest technologies. Please see the lower part of page 10 for more information about training services.

Oil and Gas Development and Production Consulting Services

JOE provides practical solutions for the examination of various proposals for oil and gas development projects.

Oil and gas production consulting services overview

JOE provides a comprehensive solution for Oil and Gas projects covering: feasibility studies, verification studies for technical, economical and/or social soundness, operation and maintenance consultation through decades of experience and knowledge gained from participating and/or implementation of various projects in the Asia, Oceania, Middle East, Europe and FSU, North and South Americas, and Africa. JOE was initially established for providing such services as facilities maintenance and repair works for the Sodegaura Refinery Plant of Fuji Oil Company as the core business, but as years passed, the company has evolved and extended these services to cover maintenance and construction of petroleum refining equipment, petrochemical facilities, and upstream production facilities. JOE, as a total consulting company of energy on the oil and gas sector, offers high quality services by utilizing the latest software and our rich experience and knowledge from upstream to downstream.

Major services for oil and gas development and production consulting

- Project master plan establishment
- Validity evaluation of projects through technical, commercial and social aspects
- Evaluation of oil and gas development and production activities
- Measurement of effective utilization of natural gas
- Bridge and information infrastructure planning
- Facility modernization planning
- Facilities diagnosis and maintenance planning
- Technical survey on facilities construction technologies, operation evaluation, research and development (R&D)
- Implementation of various feasibility studies

Oil and Gas Production Facilities Engineering Services

JOE provides safe and efficient design engineering for onshore/offshore oil and gas production, storage and shipping facilities.

Oil and gas production facilities engineering overview

JOE carries out engineering design services for production, storage and shipping facilities for both onshore and offshore oil and gas fields ensuring safe and efficient operation with our professional engineers having wide expertise and technical know-how in process, mechanical, piping, control, instrument, electrical, civil, construction, environment and safety as the backbone of our business. Furthermore, JOE also has extensive experiences in oil and gas pipeline projects.

Experience in oil and gas production facilities engineering

- Basic Engineering and Detailed Engineering for oil production facilities
- Basic Engineering and Detailed Engineering for booster gas compressor system
- Basic Engineering for renovation and new installation of anti-corrosion facilities
- Conceptual Engineering on surface facilities for CO₂-EOR
- Basic Engineering for offshore drilling, production, storage and shipping facilities
- Conceptual Engineering and Basic Engineering for offshore waste water treatment system
- Basic Engineering and Detailed Engineering of zero flaring for offshore oil production facilities
- Conceptual Engineering and Pre-FEED on offshore surface facilities for CO₂-EOR
Health, Safety, Environment (HSE) Consulting Services

JOE provides sophisticated HSE services from development to abandonment.

**HSE consulting service overview**

HSE management is an integral approach in oil and gas development projects to ensure health and safety of all personnel affected by the projects and to achieve local and global environmental conservations, aiming at sustainable development with eco-friendly technology and partnership with communities concerned. JOE provides a variety of HSE related consulting services throughout the project lifecycle, from exploration, development, production to abandonment.

JOE has been seriously involved in tackling issues of the global warming and zero emissions through implementation of various consulting services such as greenhouse gas management and effective waste management by recovery and reuse of valuable materials in the wastes. Geothermal energy development, one of our new challenges to renewable energy development, is inclined to delve into by utilizing our long-standing expertise in oil and gas field.

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Project Management Services

Our professional staff perform project management on behalf of our clients throughout the petroleum development project.

**Project management overview**

JOE implements total project management in various aspect and phase of the project. JOE carries out Gas Transmission and Distribution Project (South Sumatera - West Java) in Indonesia and Crude Oil Export Facility Reconstruction Project in Iraq. For the services, JOE provides a team of experienced personnel, who can deliver effective management services to the client, including assistance/support of tender package preparation, bid evaluation, cost and schedule control, material procurement, construction supervision and inspection, commissioning and start-up.

**Major services for project management**

- Tender package preparation, tender evaluation
- Project schedule and cost management
- Procurement management
- Fabrication and construction management and supervision
- Inspection and test attendance
- Start-up support
- Project documentation management

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Training Services

JOE provides education and training services about oil and gas field development technologies for all technical engineers.

**Training Services**

Our training program provides the participants with an all-around skill of reservoir engineering, reservoir simulation, geostatistical analysis, etc. In addition to that, JOE provides in-depth training programs related to process theories applied in the oil and gas processing facilities, process simulation, pipeline design, offloading system and HSE management, based on the knowledges and know-hows accumulated for many years through production and engineering consulting services, engineering services, and HSE consulting services.

**Featured Experiences**

- Training on engineers from oil-producing countries (Reservoir engineering)
- Petroleum skill development seminar in Saudi Arabian and Kuwait
- Reservoir analysis and simulation and EOR training for Iraqi
- Training for Thai young engineers (Reservoir engineering)
- Training for Kuwait students (Reservoir engineering)
- Training for Japanese reservoir engineers
- Technical solutions training (Zero Emission, HSE management)
- Training of technological development on crude oil pipeline and export facilities for Ugandan
- Training of designing water injection facilities
- Training on risk management and environmental assessment for offshore oil and gas field development
- Domestic training for environment basics on oil and gas development activities
- Domestic training for operational technologies on production facilities in oil and gas field
Field Experiences

JOE has been involved in resource development projects in various areas around the world and our services have been appreciated by our clients. We provide our services on resource analysis and evaluation during development, and subsequent activities such as master plan establishment, design, construction, operation, improvement and optimization plan establishment in relation to environmental and safety services by using our knowledge and experiences at every phase of the project cycle. Our business contributes to the international community by passing on the finite resources and invaluable nature to the next generation and providing one-stop solution from mining exploration development to decommissioning through production.

Representative example
Methane hydrate Development-related projects

This project is the study of CO2-EOR to the oil reservoir which has been already developed for a long time and is at the end stage of its production life. When CO2-EOR was conducted, which is one of CO2-EOR, CO2 gas and water are alternately injected into the formation in CO2-WAG process, in simple water-brine, some of the oil is trapped in a formation due to capillary effects and the like. In contrast, CO2 injection decreases yield of oil, and it is common sense of the technology. When the study was initiated, it was observed that CO2-WAG enhances the oil recovery effect of the injection of the CO2 in the oil reservoir. The implementation of this simulation and the interpretation of the results need deep knowledge of reservoir simulation and reservoir engineering. The software is provided with various types of numerical reservoir simulators for reservoir management.

[For details, please refer to the following link. ]

CO2-EOR/ CCS-related Projects

The Project for Strengthening Environmental Management in Petroleum Exploration and Production Gulf and its Coastal Area

The reserves currently being developed are only confined to the southwest. East and offshore, and offshore production. In this project, JOE has successfully conducted the environmental impact assessment of the existing facilities. The project mainly focused on four areas: 1) Preparation of Initial Project Environmental Impact Assessment Report (IP-EIA); 2) Evaluation of the environmental impact of the new project (EIA); 3) Bankable feasibility study which conducted the feasibility study; 4) Technical advice for the newly developed project. In the project, JOE supported the following for the Ministry of Environment and its subsidiary organizations in order to improve the environmental management in the petroleum industry: 1) Preparation of Initial Project Environmental Impact Assessment Report (IP-EIA); 2) Bankable feasibility study which conducted the feasibility study; 3) Technical advice for the newly developed project.

[Please visit our company website for more details and other projects] [http://www.joe.co.jp/en/japan]

Vietnam CO2 Impact Study and Planning of CO2-EOR Pilot Test

The objective of the project is to evaluate the potential for CO2-EOR in Vietnam and to conduct a feasibility study of a CO2-EOR pilot project. The pilot project will be located in a mature oil field in the Vietnam CO2 impact study and planning of CO2-EOR pilot test. The project will involve the following activities:

1. Characterize the CO2 storage potential in Vietnam.
2. Evaluate the technical and economic feasibility of CO2-EOR in Vietnam.
3. Develop a pilot project plan for CO2-EOR in Vietnam.

[Please visit our company website for more details and other projects] [http://www.joe.co.jp/en/japan]

Consultancy service for preparation of HSE documents on geothermal resource development

[Please visit our company website for more details and other projects] [http://www.joe.co.jp/en/japan]

Technical Training around Crude Oil Pipelines and Loading Facilities to Engineers

[Please visit our company website for more details and other projects] [http://www.joe.co.jp/en/japan]

Technical and Environmental Review of FPSO Projects

[Please visit our company website for more details and other projects] [http://www.joe.co.jp/en/japan]

Reservoir Simulation Study in Middle East

In this area, the client required the technology to simulate the pressure of reservoir harmonization and the simulation of the effect of fluid recovery, water injection and gas injection in various fields. The simulation study is to contribute to an improved understanding of the reservoir behavior and to enhance the future production performance of multiple case settings. JOE proposed the optimal production schemes.

Software

In geology-related services, JOE analyzes geological and geophysical data, evaluates various reservoir parameters and calculates an original oil in place using commercial software such as Schlumberger’s Petrel. We also construct and/or evaluate geological models and reservoir models applying geological methods.

In reservoir simulation-related services, there is a wide variety of reservoir simulation models such as black-oil, compositional, natural fracture, thermal and compositional. The software model should be selected depending on the reservoir characteristics, fluid properties and production techniques. By using the best model for target field, JOE can perform history matching of the production history (observation data of oil and gas) and forecast the future production profile.

Surface

JOE fully utilizes Aspen HYSYS® process simulator capabilities to develop simulation models of new and existing processing facilities and estimate solutions for facility bottlenecks. Along with process simulation model establishment, we estimate costs using Aspen Process Economic Analyzer and Aspen Capital Cost Estimator in the stages of conceptual and basic design phase. We also utilize PIPESM® licensed by Schlumberger to perform the calculation of gas lift operation performance, production history matching of producer/injector wells, and pipeline flow simulation.

As the sole user in Japan, utilize OGM (Oil & Gas Manager) licensed by SIEMENS for cost estimation of oil and gas field development in onshore/offshore in every region. In addition, we have recently introduced an engineering software OIL, which is a corrosion and scaling simulation program, to prevent and minimize corrosion/scaling that occur during oil and gas production. Besides these, we have a wide array of software such as computational drawing software AutoCAD and AutoCAD R14, and finite element stress analysis software AutoPIPE as software of plant design and construction, electrical transient analysis program ETAP as an electrical power simulator, safety software, visualization software BowTieX Standard, among others.

[Please visit our company website for more about software] [http://www.joe.co.jp/en/software]
**History**

**Brief history of 50 years since the foundation of JOE, focusing on technologies**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event/Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>Establishment (June 1968)</td>
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<tr>
<td></td>
<td>The company was established in June 1968 as JOE Engineering Co., Ltd., for the purpose of providing engineering and maintenance works to Kasedaya refinery of Koyo Koki Co., Ltd. Since its establishment, JOE has continued to succeed its parent company &quot;Koyo Koki Engineering Co., Ltd.&quot; and has also been engaged in various fields, including offshore construction, engineering, and maintenance services from drilling to shipment for Elf Field Office of Arakawa Co., Ltd.</td>
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<td></td>
<td>Pioneer of reservoir estimation/simulation study in Japan (1968-1978)</td>
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<td></td>
<td>JOE started surface evaluation of petroleum reserves, e.g., static data analysis and preliminary basic evaluation for simulation studies in areas such as the Middle East and Southeast Asia. In that time, it was not possible to exist a large and expensive computer in the office. Therefore, JOE had been doing appropriate solutions to conduct a useful simulation as possible.</td>
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<tr>
<td></td>
<td>Support for overseas state-owned oil companies during the critical period of the 1970s oil crisis (1978)</td>
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<tr>
<td></td>
<td>JOE provided a major plant development supervision and human resource development (geology, reservoir engineering, and field development) for the various overseas oil companies, including PEMEX, Petroecuador, and others.</td>
</tr>
<tr>
<td></td>
<td>Evaluation study of oil and gas production facilities in EIA (1977-1982)</td>
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<tr>
<td></td>
<td>JOE received a contract from the Ministry of Petroleum Resources and Minerals of Saudi Arabia for performance evaluation study of major oil and gas production facilities (oil/gas separators) in the country.</td>
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<tr>
<td>1978</td>
<td>Introduced simulation technology for geothermal development for the first time in Japan (late 1970s)</td>
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<tr>
<td></td>
<td>JOE introduced simulation technology to geothermal development for the first time in Japan, applying knowledge about geology and reservoir engineering acquired in oil development project. JOE had worked further on research of evaluation method of geothermal development project, geothermal reservoir analysis, and reservoir simulation studies.</td>
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<tr>
<td></td>
<td>Offshore Oil and Gas Field Development in Japan (1980)</td>
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<tr>
<td></td>
<td>JOE carried out a comprehensive study and engineering services for development of Bellows oil field in Brunei Bay, consisting of field development, construction and operation of production, storage and loading facilities. The services included project feasibility study, engineering and design, operation and maintenance procedures, material control and quality development for operational personnel.</td>
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<td></td>
<td>Development of CO2 EOR simulation started in the early 1980s (1983)</td>
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<td></td>
<td>In 1983, JOE began collaborative research and development of a reservoir simulator used to predict production behavior when CO2 is injected in oil fields for the first time in Japan.</td>
</tr>
<tr>
<td>1988</td>
<td>The first overseas EOR demonstration project by Japanese companies (1988)</td>
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<tr>
<td></td>
<td>JOE jointly implemented the first overseas EOR demonstration project (government of denmark) in relation to geothermal development. JOE contributed as a representative for Japan, Denmark, and the United States. This project was the first offshore oil field to be used for CO2 EOR in the Western East, Southeast Asia, and North America.</td>
</tr>
<tr>
<td></td>
<td>JOE was awarded consultancy and basic design for a oil field development project in the South China sea. It was a very large project because caving rock facilities consisted of a joint shared production field and production facilities. JOE provided consultancy services for the design and the platform was commissioned without large modification and has been in operation since then.</td>
</tr>
<tr>
<td></td>
<td>JOE provided EPCI services for Kure oil drilling platform (Kure Oil Field, Arakawa Oil Co., Ltd. in this project). JOE introduced a process automation technology (DCS) operation system, and provided an advanced approach at that time, making stable and safe operation possible regardless of the skill of the operator.</td>
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<tr>
<td></td>
<td>PMC for Offshore Oil Field Development in Vietnam (1994-1996)</td>
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<tr>
<td></td>
<td>JOE, as a project management consultant (PMC), was involved in oil fields development project in the South China Sea, Vietnam. This project consisted of exploration of WIP (West Vietnam Platform, PMD (Plainland Production Development) and pipelines. The project was the first case in a Japanese reef oil field development.</td>
</tr>
</tbody>
</table>

**Corporate Data**

**Company Name**

Japan Oil Engineering Co., Ltd.

**Address**

1-7-3, Kachidoki, Chuo-ku, Tokyo, 104-0054, Japan

**URL**

http://www.joe.co.jp/en/

**Establishment**

June 20, 1968

**Paid-up Capital**

600 Million Yen

**Shareholder**

Arabian Oil Company, Ltd.

**Member of the Board**

President - Representative Director

President - Representative Director

Hidetaka SUZUKI

Yukihiko MATSUMOTO

Toshiro YOSHIDA

Jurici MARCH

Non-executive Directors

Masanori KURIHARA (Ph, D)

Tezumi NAKAMOTO

Yoshitani YAMASAKI

**Audit & Supervisory Board Member**

Number of Employees

48 (As of April 1, 2018)

Written in red on paper are for Subsea area (Petroleum Engineering & Consulting Dept.) and blue for Surface area (Project Engineering Dept.)
