**Project definition**

Petrofac undertakes field development planning, feasibility, concept and FEED studies for offshore and onshore projects. It is during these phases that our Engineering Services consultancy team can potentially provide world class solutions to positively progress the project forward both technically and commercially. We execute work for both greenfield/new and brownfield/existing developments.

Petrofac has extensive experience in the design of onshore/offshore facilities for both oil & gas treatment facilities and, therefore, is able to produce designs that are fully integrated with any downstream facilities.

Our concept development work is supported by a cost estimating function that reflects the very latest cost information through our worldwide procurement capability.

At the concept level our design teams provide robust and practical solutions which incorporate Petrofac’s extensive EPC and operations experience both onshore and offshore. This experience has been gained through executing projects in some of the most environmentally and climatic challenging regions of the world. Using this approach ensures that the correct level of experience is mobilised at the earliest opportunity within a project where its influence can add the most value.

**Integrated field development planning**

For execution of field development planning, Petrofac consultants and engineers are accustomed to interfacing with client sub-surface personnel to jointly develop the optimum sub-surface/surface solution for the asset. Hence, particularly within our consultancy team, there is an understanding and appreciation of the potential issues associated with aspects such as flowing wellhead pressure on productivity, gathering network pressure drop, artificial lift methods, water injection for reservoir pressure maintenance, gas injection for reservoir pressure maintenance and plateau production periods. Our workflow methods for feasibility and concept studies typically include means of handling data uncertainty by developing and costing options for variation in wellhead/arrival pressures, artificial lift and injection/disposal of gas and water and fluid composition.

**Offshore concept development**

Identification and assessment of development options for offshore facilities, whether they are based on fixed or floating structures concepts, is crucial in the selection of the most cost effective solution to take forward to the following project phases and to support customers’ investment decisions.

**Feasibility phase**

The objective is to demonstrate both technical and economic viability.

Petrofac recognises that every project is unique and we develop specific solutions considering issues such as hydrocarbon properties, impurities (H2S, wax, sand, salt), production gathering system architecture, plant and camp location, processing scheme, refinery configuration, export & storage of products (oil/gas/NGL/LPG/LNG, gasoline, diesel, kerosene), power generation, utility systems integration and enhanced oil recovery methods. Our cost estimates at this stage are developed at screening level.

**Concept phase**

On completing feasibility assessment, the objective would be to select the best option(s) and further define to reduce risk and improve project cost estimate accuracy. Typical issues include; multi-phase or single phase production flowlines, optimum facilities location, conceptual plant layout, materials selection for plant and pipelines, process plant technology selection (oil, gas, LNG, refining and GTL), process and safety studies, operability, control, overpressure protection, power generation/supply, machinery selection, long lead item identification, environmental and disposal issues.

The cost estimate will consider market conditions, construction methodology, country specific infrastructure and labour productivity. Our estimating function utilises the very latest cost information through our worldwide procurement capability.
FEED phase
Following successful option identification and assessment during the concept phase, a FEED is an essential part of the project lifecycle. A robust FEED will deliver not just the final concept to be taken forward into construction, but will also provide the estimate for final sanction together with the documentation for the next contracting phases. In addition, in the current climate where schedules are challenging and key equipment often on long delivery times, the FEED output will enable procurement activity to commence prior to main contract award.

Offshore FEED
We have extensive experience in executing projects for offshore oil and gas production facilities including the development of both greenfield and brownfield developments that cover the following:

- minimum facility fixed platforms
- floating production, storage and offloading (FPSO)
- integrated drilling, processing and export platforms
- mobile drilling and production units
- subsea production facilities

Our core facilities design expertise is supplemented with specialist offshore capability that includes installation design (transportation and lifting), mooring analysis, riser design, offshore piling design, vessel motion analysis and flow assurance.

Onshore FEED
Our onshore FEEDs are supported from our full in-house multi-discipline engineering resource pool including:

- process engineering (including flow assurance and dynamic simulation)
- instrument engineering (control systems, field Instruments and metering)
- electrical engineering
- metallurgy and materials engineering
- piping layout design
- piping engineering (including piping stress analysis and materials)
- civil engineering
- structural engineering
- risk, safety & environmental engineering
- pipeline engineering

Group synergies
In addition to the experience and capability within Petrofac Engineering Services, we can call upon a range of Petrofac group companies in order to deliver an optimised development service.

These include:

- Plant Asset Management (PAM)
  - maintenance and structural integrity
  - operational and project management consultancy
- well construction and operations (SPD)
  - well construction, well engineering and drilling consultancy
- petroleum technology (Eclipse)
  - field development optimisation
  - production modelling
  - well life cycle risk management
  - production optimisation software - PetroAtlas™

Global support
The Engineering Services consultancy is a company centre of excellence for conceptual development studies. Its experienced personnel provide consultancy and support from feasibility through all phases of project to all aspects of operation, maintenance and inspection to its customers around the world as well as to other Petrofac offices in Sharjah, Chennai, Mumbai, Indonesia, London and Aberdeen.
Offshore design experience
Petrofac has been involved in a variety of projects that include the following:

**Norwegian North Sea: conceptual development of floating production facilities**
Conceptual development of facilities to support 60 – 100,000 bopd production in a 400m water depth in the Norwegian North Sea. Options considered covered both new build and using an existing FPSO.

**Tunisia: conceptual and FEED design of normally unmanned facilities**
Concept development followed by FEED for normally unattended facilities to support new 150 MMSCFD gas processing and treatment plant. Scope included a 110km 18" multiphase subsea pipeline.

**Malaysia: concept development using mobile production unit**
Concept development in 65m water depth using wellhead tower, converted mobile production unit and tanker offloading system.

**UK North Sea: concept development and FEED for Southern North Sea**
Concept development for shallow water gas development that included the use of an innovative subsea cooler system.

**Nigeria: FEED development for shallow water fixed platforms**
FEED for near shore facilities for production of 60,000 bopd. The facilities included separation, utilities and power generation and were bridge linked to existing facilities. Petrofac subsequently undertook the detail design of the facilities.

**UK North Sea: FEED and EPC for tie-back facilities**
Additional module for single well tie-back to support 15 MMSCFD production together with compression facilities and 10km subsea pipeline. Concept based on standalone “hang off” module installed on an existing platform was specifically designed to maximise onshore completion and commissioning thus minimising expensive offshore construction work.

Onshore design experience

**Algeria: concept study for LPG extraction system**
Study to investigate technology options and development of optimized LPG extraction system. Scope included integration with existing facilities and preparing design and operating philosophies, preliminary plot plans, safety and constructability reviews, interfaces and tie-ins and a CAPEX cost estimate.

**Turkmenistan: conceptual design & FEED of early production phase**
Concept study and design of 5BCMA treated gas export from future 20BCMA project gathered from 40 operating wells.

**Oman: concept engineering on four fields.**
Study to identify and cost a minimum equipment development scheme for the production of 170 MMscfd gas with minimum overall cost fit for purpose gas receipt facilities to transfer gas and condensate from the fields to the gas plant.

**United Kingdom: conceptual and feasibility studies for oil and gas field developments**
Field development planning studies, pre-FEED and FEED engineering, technical assurance, risk, safety and environmental engineering.

**Tanzania: conceptual development of onshore facilities**
Conceptual development of facilities fed from 3 offshore and 12 onshore wells, to increase production from 70MMscfd to 110MMscfd.

**Algeria: FEED design competition**
FEED for oil and gas gathering system and central processing facilities to tie in to existing facilities. Peak oil production of 30,000 BOPD with 100 MMscfd gas.

**Uganda: FEED service for oil plant and export pipeline**
Production gathering, main process plant with capacity for 40,000BOPD and 80km heated pipeline.

**Kazakhstan: FEED project for phase III facilities**
FEED to manage the increasing Gas Oil Ratio (GOR) of the reservoir fluid with time and capturing the value in the gas reserves. Project focused on delivery of 16 BCMA of gas to existing customer in Russia, which entailed an increase of approximately 8 BCMA over previous gas export quantities.

**Gabon: conceptual design for gas treatment and compression facilities**
Concept for gas treatment and compression systems with water make-up, treatment and injection facilities including associated pipelines/flowlines. This involved maximising the use of ‘free-issue’ turbo-machinery (LP & HP compressors, power generators and water injection pump).