

INTRODUCTION TO CRISTOHOUSTON ENERGY (CHE) PRODUCTION SERVICES:

CHE Services Limited is incorporated in Nigeria to deliver cost effective, practical and proven solution to all your oil & gas treating and processing needs. We offer flexible and dynamic approach with appropriate solutions tailored specifically to your exact requirements.

With our alliances with major Original Equipment Manufacturers, we leverage on world class oil & gas experience that enables us offer superior, quality, safety and economical solutions to the Nigerian oil & gas industry. We have specialized in the ability to deliver as promised every time while complying with the local content mandates. We possess all the ingredients for success.

We offer a key range of production solutions, including:

- Early Production Facilities
- Permanent Production Systems
- Mobile Offshore Production Units
- Production Enhancement packages
- Water handling and treatment plants
- Seawater injection packages
- Production testing, including in-line and extended well testing

CHE Production Services Capability

- Early Production Facilities on a lease, operate, maintain (LOM) or equipment sale basis
- Life of Field (Permanent Production) facilities, delivered on a “Fast Track” EPC basis with design life from 10 to 25 years.
- Facilities are purpose built or existing facilities can be mobilized
- The business unit has in house engineering, design and procurement capabilities and will deliver a completed plant, fully commissioned on a ‘fast track’ basis
- Technical testing solutions where the parameters are challenging; HPHT, heavy oil, high gas condensate wells, solids production, high water production
- The business unit will also provide resources and equipment for debottlenecking, water handling and FEED studies

Onshore Central Production Facilities

Once the production profiles are established and a long term investment is justified, CHE offers the Complete Production Facility comprising of Oil, Gas and Produced water treatment trains compliant to environmental regulation and long design life with required infrastructure, Storage, Pipelines and utility systems. These facilities too can be offered as a modular solution up to certain size to minimise site engagement.

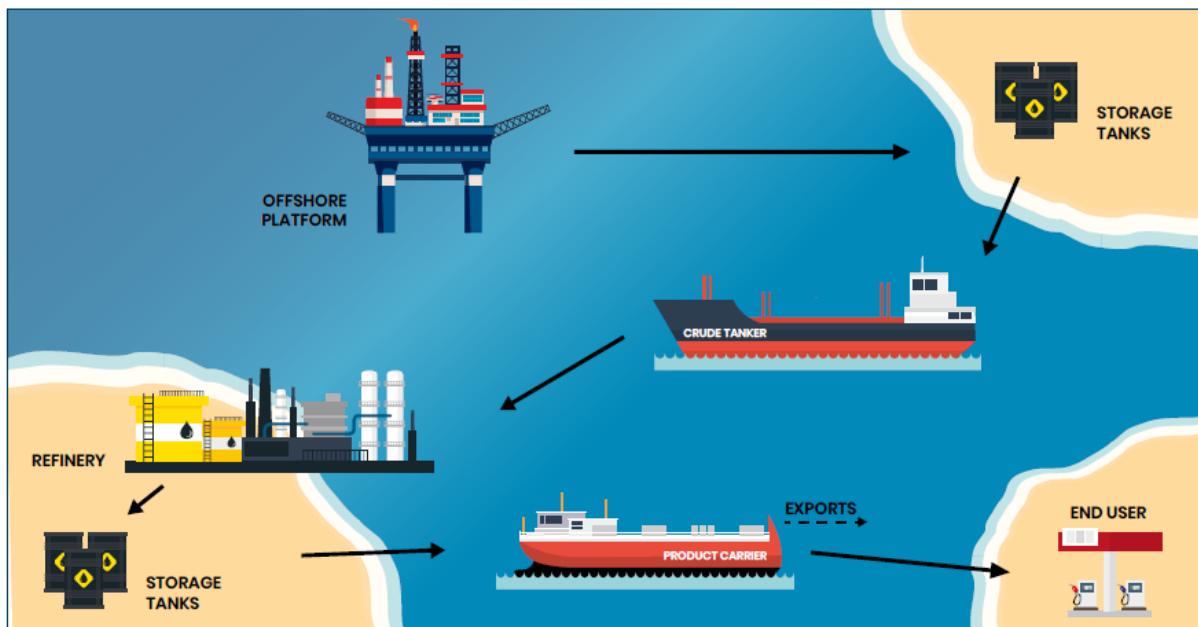
Offshore Production Facilities

CHE has experience in modularised systems for offshore production facilities and provides complete topsides from its Mundra Modular Fabrication yard for following installations:

- Offshore Platforms
- Rig Conversions (MOPU)
- Ship Conversion (FPSO)

In cooperation with the ship conversion partner, CHE provides complete solution for Floating Production and Storage operation (FPSO) from its Houston office.

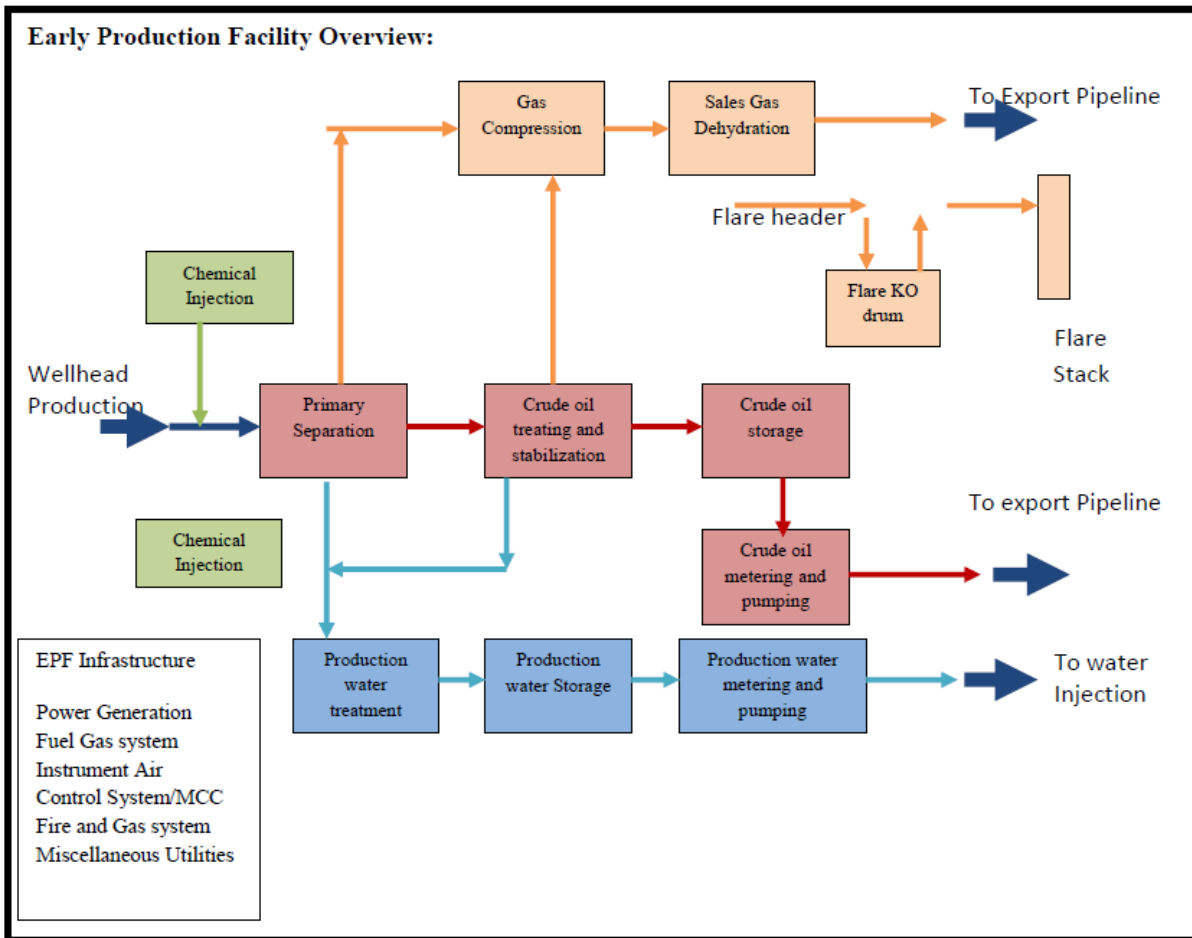
Oil and gas production Value chain



Product Definition

From discovery to commercial production, time is the key to achieving top financial performance. To ensure rapid production of your new oil and gas finds, CHE has developed Early Production Facilities (EPFs), combining our family of CHE technologies and solutions with Frames specifications and a modular approach.

Our Early Production Facilities combine our proven CHE technologies and leading technical solutions to deliver high performance production facilities where and when you need them. As a result, you benefit from flexible modular designs, extensive in-house experience, efficient transportation options and a global supply chain for rapid commercialization of your oil and gas discoveries.



Early Production Facilities:

Early production facilities (EPFs) are process facilities that enable you to

- put wells into production faster and
- Recognize cash flow as quickly as possible while continuing to obtain flow data.

With our in-depth understanding and production experience covering all of the individual processes required for processing upstream hydrocarbons, CHE Systems are able to create Early Production Facilities (EPF) to suit every kind of production type and volume.

Whether you need to deal with

- heavy or
- light liquids,
- sweet or
- sour gases,
- oily or sandy water,

CHE Systems will have already designed and delivered a skid mounted package somewhere in the world and can leverage that experience to not only produce a bespoke Production Facility but - to really put the "Early" into "EPF" – CHE Systems can turn out your plants with record-breaking deliveries.

CHE Systems offers a range of technologies that will cover most of your EPF needs including:

- Two and Three Phase Separation
- Gas Sweetening Packages
- Gas Dehydration Packages
- Dew Point Control Units
- Oil dehydration, desalting and heating
- Produced Water Treatment Packages
- Sand handling
- Fuel gas processing
- Flare systems
- Fire and gas utilities

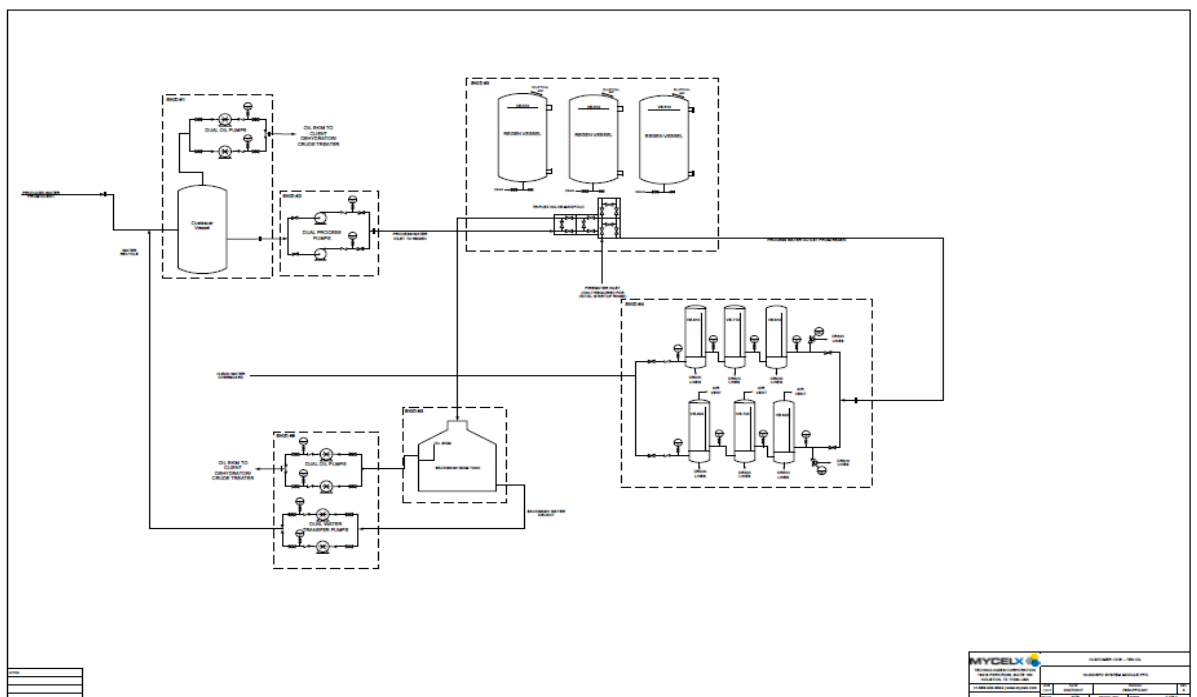
CHE Systems offers custom design and fabrication of process packages for any type of gas processing including gas dehydration, gas sweetening and dew point control to name a few.

Water Treatment

CHE Systems' specialist and patented technologies mean we can supply effective and compact treatment systems to remove oil and other contaminants from produced water to the level required for disposal or reuse. The CHE solution for produced water treatment is the complete oil removal system that includes

1. Primary, (MYCELX Advanced Separator)
2. Secondary (Re-Gen)
3. Tertiary that utilizes the patented CHE filtration media. (Polisher).

POSSIBLE PWT DESIGN: PFD



PWT TRACK RECORD:

CLIENT: NECONDE

FIELD: OML 42 JONES CREEK

YEAR: 2016

TYPE: PRODUCED WATER TREATMENT FACILITY

SCOPE: Capital, Operate & Maintain

SHORT DESCRIPTION:

In 2015 Neconde Energy, awarded us a contract to supply and operate a 40k BWP produced water treatment facility for their Jones Creek OML 42 as part of the upgrade of Jones creek facility from 2 phase flow station to 3 phase permanent facilities. The facility was seamlessly delivered from design to installation and commission.

Picture of output after installation:



Picture during installation:



Pictures after installation:



CLIENT: ORIETAL OIL AND GAS

FIELD: OML 67 EBOK FSO

YEAR: 2015

TYPE: PRODUCED WATER TREATMENT FACILITY PILOT

SCOPE: Capital, Operate & Maintain

SHORT DESCRIPTION:

In 2015 Oriental, awarded us a contract to supply and operate a 50 gpm pilot system on their FSO VIRINI PREM as a trial for the supply of 30k BWP produced water treatment facility for their EBOK FSO MOPU facility offshore AKWA IBOM. The facility was seamlessly delivered and DPR issued Oriental a temporal reprieve to discharge their effluent using our technology.

Picture of the VIRINI FSO



Picture of CHE equipment on the virini



CLIENT: ORIETAL OIL AND GAS

FIELD: OML 67 EBOK FSO

YEAR: 2016

TYPE: PRODUCED WATER TREATMENT FACILITY

SCOPE: Capital, Operate & Maintain

SHORT DESCRIPTION:

In 2016 Oriental, awarded us a contract to supply and operate a 30k BPD Produced water treatment system on their FSO VIRINI PREM as a permanent solution after the successful trial/pilot project with a 50 gpm facility, for their EBOK FSO MOPU facility offshore AKWA IBOM. The facility was seamlessly designed and passed DPR FAT now waiting for Oriental for deployment and installation.

Pictures of Facility after fabrication:

Pictures of during FAT



CLIENT: *Chevron USA*

FIELD: *Jack St. Malo, Blind Faith, Frade, Tahiti, El 238*

YEAR: *2010 - Date*

TYPE: *PRODUCED WATER TREATMENT FACILITY*

SCOPE: *Capital, Operate & Maintain*

SHORT DESCRIPTION:

Currently Chevron is changing out or retrofitting most of their offshore gulf of Mexico facilities for our technology.

EQUIPMENT DELIVERY SCHEDULE

PWT Timeline from Order to Receipt on Site.

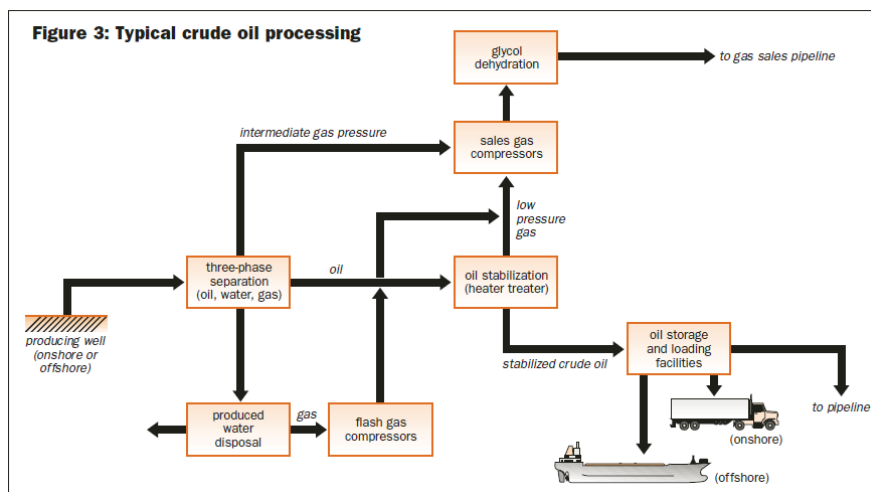
Design and fabrication 6 weeks

Logistics from Houston Port to Nigeria Port 6 weeks

Total time from order to delivery 12 weeks

Oil Treatment

Following primary oil/water separation crude oil still contains residual amounts of water containing unwanted salts that need to be removed in order to avoid undesirable effects downstream such as fouling.



CHE Systems offers a range of crude oil dewatering and desalting technologies that cover most typical processing requirements depending on the salt level required. These include:

- Free water knock out drums
- Heater treaters
- Dehydrators
- Coalescers
- Electrostatic desalters
- Degassers

The benefits and features of our electrostatic and mechanical treaters include:

- Low maintenance
- Excellent turn-down performance
- Adjustable for load and voltage resulting in high operational flexibility
- Effective design means minimal chemical treatment

Solids Management

Efficient solids removal is essential for trouble-free plant operation so CHE Systems supplies separator systems for the collection, removal, cleaning and disposal of accumulated solids in production facilities.

Our solutions include

- Desander Cyclones that are a proven efficient and reliable solids separation technique.

Desanders are typically installed at the wellhead or downstream of the initial 3-phase separator in order to remove solids to protect downstream equipment

For wells where more data is needed to define the reservoir characteristics, or to better define the produced fluids in order to establish design parameters for production facilities, we apply traditional well testing equipment for an extended well test. The opportunity exists to store produced oil for later sale, such that the cost of the extended test may be offset by the sale of oil from production.

When evaluating the need to provide production to enable early cash flow from wells where no permanent production facilities exist or from reservoirs too small for conventional facilities, EPFs provide the needed alternative.

The ability to implement your process facility specifications begins by creating a true partnership with you from the beginning. During the initial front-end engineering and design stage, we focus on the design requirements. From the initial requirements, we have the ability to “fast-track” facilities specially designed to meet requirements or provide facilities around standard process modules for well control, separation, fluid conditioning, and disposal.

CHE difference comes from our experience in project management, supplier coordination and relationships, ability to adapt to changing specifications, and in handling complex logistical requirements, as well as in our ability to offer flexible commercialization schemes to meet your project provisions.

Twelve Steps to Engineering Safe Oil and Gas Facilities:

- **Set a Design-Standard Policy**

“All facilities will be designed in accordance with good industry design practices and codes, and also to meet all regulatory requirements.”

American Society of Mechanical Engineers (ASME)

B31.3 *Chemical Plant and Petroleum Refinery Piping* (1993),

- **Lay Out the Site for Safety**

In planning the equipment layout, one must obtain a plot plan of the site and an equipment list showing the equipment to be installed. of interest include

- a) Vents that may discharge poisonous gases (hydrogen sulfide) or flammable gases.
- b) As with vents, flares should be located as far away downwind from other equipment as possible.
- c) Fired process equipment should next be located on the plot plan. Examples of fired equipment include heater treaters, heater/ separators, glycol reboilers, amine reboilers, and process heaters.
- d) Engines and rotating equipment, such as pumps, should be located on the site to prevent harm from possible hydrocarbon releases, ignition, noise, and other factors.
- e) Separators, tanks, and unfired vessels should be the next set of equipment items to be located on the plot plan. Separators and unfired pressure vessels should be located so that their associated relief devices are designed to relieve to a safe area.
- f) Site offices, electronic control equipment, batteries, and electrical switchgear should be placed at the site in the safest location possible. Usually, this is far away from vents, flares, fired vessels, and engine-driven components. Site offices usually have the highest occupancy level of any structure on the site. Nonclassified electrical equipment, such as computers, air conditioners, heaters, electrical outlets, and other devices that could be a source of ignition, are located in site offices.

- **Personnel Safety.**
- **Design Piping Properly**
- **Select the Proper Pressure Vessel.**
- **Picking the Right Tank**

- **Specifying Rotating Equipment for Safety**
- **Relief-System Design Is Critical.** The purpose of a relief system is to protect piping and equipment from an excessive overpressure.
- **Determining the Right Electrical-Area Classification.**
- **Design the Instrumentation and Control System for Safety.** Instrument alarms and shutdowns provide the first level of safety in the event that a process upset occurs.
- **Conducting a Process Hazard Analysis.**
- **Design Verification and Commissioning**

Installation & Commissioning

- CHE Operations personnel are utilised during the pre-commissioning phases to gain familiarity of the process equipment.
- For the installation phase CHE bases a team of trained engineers and operational staff at the site. In order to avoid common delays due to
 1. lack of site services,
 2. clashes with the site contractors,
 3. structural obstructions,
 4. Craneage problems, etc,

This phase is planned in detail, involving both the customer and the CHE Commissioning Team.

- A full inspection of the site is also completed prior to mobilisation of the equipment. With our experienced team of in-house operators and engineers, and management and systems to support them, CHE is able to provide our customers with marine or shore-based systems and services from completion of the well to the point of sale.

TRACK RECORD:

CHE EPFs can be delivered fast with transparent deliverables including well site equipment, utilities, control rooms, civil works, plant commissioning and long-term operation. Once on site, our team will be working with our global network of local partners to complete all site activities, and bring the facility into safe production as quickly as possible.

Project Overview and Management

We understand that effective project management requires the precise coordination of a wide range of tasks, and by working together as a family of professionals we are committed to delivering the best outcomes for our clients.

At CHE, we work as a coordinated team that focuses on integrated solutions such as Total Plant Solutions, Modules and EPF Projects. We strongly believe that our product know-how translates into added value for the management of these complex projects. Our multi-disciplinary engineering teams are managed by a project manager who is the single point of contact for our clients.

With decades of experience in working on projects of all sizes, CHE has learned to execute its projects according to the highest safety standards. Having overall process knowledge, project execution and interface management experience, CHE offers complete package deals.



Expedient Project Execution;

- Engineering continues through bidding phase
- Skid packaged equipment to avoid stick build at site
- The use of existing refurbished equipment not precluded
- Use of 'Standard Inventory' and supplier specifications
- Engineering confirms 'fit-for-purpose' designed for field life
- Client engagement throughout
- Project team involved from tender stage through to commissioning

COMMERCIAL: COST (TBD)

CONCLUSION:

Why Use a Lease Operate and Maintain (LOM) Facility

The *LOM facilities* typically will;

- Stabilize and/or treat produced hydrocarbons to export conditions
- Provide earlier cash flow from a new or re-developed field
- Provide detailed reservoir data from extended testing, sampling and draw down
- Be flexible in terms of productions rates (turndown/up)
- Be engineered, safe, fit for purpose, and available on a fast track basis
- Provide satisfactory uptime over the life of the contract
- Be commercially viable at varying energy prices
- Be available on a LOM basis, or Lease to Purchase basis

Why Use a LOM Facility

Operator Advantages

- Existing Infrastructure – Service company already has
- In-country infrastructure
- Security arrangements in-place
- Experienced fast track engineering, project and operations personnel
- Existing specifications and procedures
- Access to existing equipment
- In House Logistics

Operator Advantages

- Functional Specification only required, Operator only needs to define
- Flowing wellhead conditions
- Well fluid compositions
- Expected production rates and profile
- Export conditions
- Any additional requirements
- Location

Existing inventory of equipment that can be mobilised at short notice for use in Early Production Facility Projects where appropriate

- Accelerated Mobilisation
- Proven Technology
- Inventory of Spare Parts
- Replacement of Equipment
- Available at International Locations

Operations & Maintenance

- Developed HSE-QC systems and practises
- Strong and varied track record of production operations
- Service company culture
- National and international purchasing capabilities
- Large pool of competent engineers & operators
- Large pool of personnel for round the clock back-up