Select - Hydrocarbons
Capability & Experience
Corporate Overview

WorleyParsons is a leading global provider of professional services to the resources and energy sectors, and the complex process industries.

We cover the full asset spectrum, both in size and lifecycle, from the creation of new assets, to services that sustain and improve operating assets.

Our business has been built by working closely with our customers through long-term relationships, anticipating their needs, and delivering inventive solutions through streamlined, proprietary project delivery systems. Strong growth continues to characterize our performance both through organic development and through strategic acquisition as we strive to provide tailored services wherever our customers need us.

EcoNomics™

EcoNomics™ is our range of services and technologies that profitably embed environmental, social and financial sustainability into project delivery, across the asset lifecycle. It is a seamless extension of our established project delivery capability in the key areas of assessment, efficiency, and treatment & mitigation. We are committed to working with our customers to turn their sustainability objectives into good business practice.

Zero Harm

Zero Harm is our corporate vision for health, safety & the environment (HSE). We are committed to our vision; it applies to all of our operations, at all times, in all locations, and at all levels of responsibility. We will actively work to align our expectations and behaviors with those required to achieve our vision through a dedication to continuous improvement. The launch of our integrity management framework, OneWay™, enables us to further align and consolidate our global systems and procedures and continue to work with our personnel to reinforce a culture that underpins our drive to achieve our corporate differentiator of industry leadership in HSE performance.

There is no task so important or so urgent in our business, or our customers’ businesses, that it overrides the need to work safely.

John Grill  WorleyParsons CEO
when using this full page hero, opt to place enlarged metric for added impact
Select - delivering value through experience

Select is the specialist front-end division within WorleyParsons. It is focused on the assessment of project viability and the selection of development concepts. Select supports decision making on critical front-end planning issues that will enhance our customers’ business objectives.

Select combines the niche specialist skills required at the front-end of projects, with WorleyParsons’ extensive and practical experience in total project delivery and plant operation to advise asset owners, operators, investors, financial institutions and governments on the best path forward.

Select uses a global database, derived from major capital projects, to provide accurate and reliable planning data. This data aids our customers make strategic investment decisions and significantly increases their confidence that the critical planning decisions will underpin their business objectives.

Our Select specialists have a thorough understanding of the total business value chain including market analysis, financial modelling, technology selection, greenfield site selection, approvals management, new plant configuration, existing plant optimizations and development of detailed project realization methodologies. Strategic front-end planning skills and extensive project execution capabilities, combined with WorleyParsons’ technological and commercial neutrality, differentiates Select as a market leader in the consulting market.

WorleyParsons’ experience covers all five phases of the asset lifecycle. In each one of these phases we understand the critical issues and apply our specialist business lines, Select, Deliver and Improve to enable our customers to achieve their business objectives.

Our phased approach enables consistent project delivery worldwide and WorleyParsons’ project systems are fully aligned to this process.

WorleyParsons Project Phases

Select Project Phases
1. Identify
- Pre-feasibility screening studies
- Business model development

2. Evaluate
- Feasibility studies
- Conceptual design
- Cost estimating
- Contract planning

Deliver Project Phases
3. Define
- Preliminary Engineering (FEED)
- Cost estimating
- Execution planning

4. Execute
- Detailed Engineering
- EPCM
- PMC

Improve Project Phases
5. Operate
- Brownfield projects
- Portfolio delivery
- Asset management
- Business improvement
- Operations and maintenance support
Capability Overview

**Technical Development**
During a Select study, specialist engineering staff add ‘technical definition’ to the development concepts identified in the initial framing workshops. Traditionally, this technical definition is less than optimal because of the lack of available data on which to base a design. Select makes use of our extensive database—with information from current design projects and archives of existing facilities—to quickly assemble screening concepts. Studies are undertaken to select technology from the company’s stated position of technology neutrality, and this provides our customers with the information to compare the ‘tried and tested’ with the risk weighted ‘new and emerging’.

**Value Adding**
Phases 1 and 2 (Identify and Evaluate) are the value adding phases. It is these phases that provide the opportunity to find the up-side of the development case. Select works best through an integrated team with the customer’s staff bringing technical development in line with operational know how to identify the areas of value enhancement.
Select uses formal value improving practices to make sure our customers achieve the maximum possible front-end loading within the constraints of the development schedule and budget.

**Business Model Creation**
There are a number of ways in which Select can assist in the creation of a business model. Firstly, by creating capital expenditure (CAPEX) estimates using proprietary in-house tools: Tools designed to quickly assemble building block style estimates validated from past projects using up-to-date base rates. Secondly, by typically working with our customers, Select can build ongoing operating expenditure (OPEX) models that enable life cycle cost comparisons between competing development options.
Finally, Select can provide risk based net present value (NPV) modelling using the EcoNomics™ DELTΔ tool. This modelling can include additional external factors (such as carbon taxes) for customers seeking to future proof their businesses by analyzing a broader range of possible futures.

**Project Execution Planning**
Through Select, planning skills from the broader WorleyParsons organization are available, providing our customers access to detailed planning engineers, senior procurement staff and field construction personnel. This enables the development of a project execution plan in appropriate detail during Select. The Select execution plan covers all aspects of the project with a particular emphasis on those activities that must occur in the next project phase, to assure that customers’ objectives are met. This emphasis could include items such as planning the procurement of long lead items, planning the requirements, etc., as well as a detailed execution plan for the next project phase (Define Phase/FEED).
Cost Estimating
Accurate cost estimates are a fundamental deliverable from the Select phase of work. WorleyParsons use a component based cost estimating tool that uses pre-prepared building blocks representative of the accumulated discipline knowledge gained from previous relevant projects, complemented by development specific knowledge, and execution planning.
Arctic & Cold Climate

Our Arctic and Cold Climate Select specialists have the unique skill set required to develop projects in this harsh environment with only limited construction windows. As pioneers in Arctic developments we understand that extra focus on full field development planning, environmental permitting, modularization, logistics and execution planning are required to ensure that maximum value is created for our clients.

By addressing the risks and challenges of Arctic and other cold climates, WorleyParsons is able to offer strategic development plans, scenario analysis and cost estimation to help our clients choose the best development options for their assets.

Select provides pre-FEED services (Identify and Evaluate) to asset owners, operators and investors using our extensive experience in total project delivery, asset operation, and industry best practice.

Greenfield Development
In the area of greenfield development, Select provides strategic planning, opportunity evaluation, site and concept selection, and technology selection for major and marginal new field opportunities.

Brownfield Optimization
As a specialist business line, WorleyParsons' Select delivers cost effective increases in production to deliver whole-of-life return from existing facilities.

Strategic Advice and Financial Analysis
Select provides strategic advice to asset owners based on a thorough understanding of the Arctic business value chain. We can also provide investment advice with accurate and reliable development costs and schedule services. The early (pre-FEED) stage of any project must provide the key decision support packages needed to decrease risk and provide the economic basis to attain project sanction. Our specialists have a thorough understanding of market analysis, financial modelling, technology selection, greenfield site selection, approvals management, new plant configuration, existing plant optimizations, and the development of the detailed project realization methodologies. Strategic front-end planning skills and extensive project execution capabilities, combined with WorleyParsons’ technological and commercial neutrality, differentiates our Arctic Select offering.

Mike Paulin
Global Director, Arctic & Cold Climate
**Project** MacKenzie Gas Pipeline Project  
**Customer** Imperial Oil  
**Project Location** North West Territories, Canada  
**Phases**  
This project comprises a 1,221 km gas pipeline (762 mm diameter) and a 470 km NGL pipeline (323.9 mm diameter) with a total installed cost of US$13 billion. WorleyParsons were contracted to undertake the conceptual engineering, pre-FEED, FEED, as well as engineering and licensing services for this mega project.

This is a long distance pipeline operation with a high pressure chilled gas stream, and the overall scope of work included cathodic protection design, cost estimation, external coating selection, corrosion management, inspection services.

---

**Project** Zhambay Block Visualization Study  
**Customer** Repsol Exploration  
**Project Location** North Caspian Sea, Kazakhstan  
**Phases**  
Repsol contracted WorleyParsons to undertake a drilling operations visualization study as part of the Edil North and Karabulak development plan (Zhambay block). The severe climatic conditions experienced in winter together with the very shallow water depth in this area makes the use of conventional onshore and offshore equipment difficult.

WorleyParsons’ Select team evaluated a number of facility concepts with alternative subsea architectures and screened these options in light of the severe winter conditions. They also assessed the restrictions brought about by the local eco-system as well as its protection.

---

**Project** Goliat Riser and Flowline  
**Customer** ENI Norge Exploration & Production AS  
**Project Location** Barents Sea, Norway  
**Phases**  
The Goliat field is located 85 km offshore from Norway in the Barents Sea. The water depth ranges between 325 and 390 meters. The field was developed using subsea templates tied-back to a floating production, storage and offloading (FPSO) unit. A total of eight subsea templates are spread over five field site locations. The FPSO riser system will comprise ten base case flexible risers and umbilicals, with ten spares.

INTECSEA—which is a wholly owned subsidiary of WorleyParsons—had a scope of work that included the concept selection for riser and flowlines, lay-out development, design of riser systems, on-bottom flowlines, gas export pipeline, direct electrical heating system, development of installation methodology, as well as the project schedule estimate and cost estimate.
Floating Production Systems

The combination of Select and INTECSEA has created a world leading partnership in the conceptualization of floating facilities. Our joint experience encompasses all types of floating systems including FPSO, FPU, TLP, Spar, and semi-submersible. We can help clients to select and detail the appropriate floating unit either as a standalone project or within a broader field development.

Delivery experience
Selecting the right floating production system for a specific development is crucial and requires an understanding of what drives the overall development together with knowledge of the full range of alternatives available. This includes knowledge gained from the execution and project delivery aspect of the business. In this way, Select is unique in bringing real world experience to our conceptual studies, ensuring that not only are the best technical solutions selected, but the project can also be built and delivered on time and within budget.

Technology leadership
INTECSEA is a technology leader in the field of floating systems, and we have worked to mature many different technologies into real projects. These include the Moses TLP, Moses SSIP TLP and deepwater tender assist drilling. INTECSEA has also developed technologies to ‘project ready’ status such as the CP Semi, Ring Spar and a near surface completion concept.

System Integration
INTECSEA has a reputation for providing leading solutions in the full range of floating production systems; while Select brings expertise in process and facilities, as well as a clear methodology and framework for executing front-end work. The group has a successful track record of working with the major fabrication sites, specialist integration dockyards and leading shipyards in the delivery of floating facilities. INTECSEA and Select bring this expertise together to deliver contemporary solutions to the industry.

John Manning
Global Director, Floating Production Systems
**Project Shtokman Floating Production Unit**  
**Customer** GazProm  
**Project Location** Russian Arctic Shelf  
**Phases** Identify, Evaluate, Define, Execute, Operate  

The Shtokman gas/condensate field lies about 600 kilometers north-east of Murmansk in the Russian sector of the Barents Sea. The production vessel is a ship-shaped hull, capable of withstanding the severe sea ice conditions experienced in this region, with a topsides able to process 70 million cubic meters of gas per day plus associated liquids. WorleyParsons was responsible for the pre-Front End Engineering Design (FEED) for this project.

**Project Rosebank FPSO**  
**Customer** Chevron North Sea Limited  
**Project Location** United Kingdom  
**Phases** Identify, Evaluate, Define, Execute, Operate  

The Rosebank field is located north-west of the Shetland Islands at a water depth 1,130 meters in a very hostile environment. The field is operated by Chevron North Sea on behalf of itself and the following partners: Statoil (U.K.) Ltd, OMV (U.K.) Ltd, DONG E&P (U.K.) Ltd  

Initially, WorleyParsons executed an extensive Pre-FEED for the entire facilities including topsides, hull, marine, mooring, subsea and gas export systems. A Class 2 cost estimate and Level 2 EPCI schedule was also developed to support Chevron approvals. In addition, WorleyParsons developed a UK compliant, fully-integrated FPSO model in 3-D using PDMS showing details of the topsides process, utilities, hull, marine, turret, mooring and offloading systems.

**Project Equus Offshore Facilities**  
**Customer** Hess  
**Project Location** Western Australia  
**Phases** Identify, Evaluate, Define, Execute, Operate  

The Equus offshore facilities are located 180 km offshore, north of Exmouth in Western Australia, in a water depth of more than 1000 meters. The facilities comprise a semi-submersible production facility, including risers and moorings. Its design flow rate is 325 MMscfd and includes gas/liquid separation, glycol regeneration, gas dehydration and the export of gas/condensate. WorleyParsons’ specialist joint team from Select and INTECSEA undertook the pre-FEED services for this project.

**Project Pyrenees FPSO**  
**Customer** BHP Billiton  
**Project Location** North West Shelf, Western Australia  
**Phases** Identify, Evaluate, Define, Execute, Operate  

The Pyrenees development is located on the North West Shelf of Western Australia in a water depth of 200 meters. WorleyParsons’ Select were asked to undertake the pre-feasibility (Phase 2) study to determine the best solution for, and the viability of, the Pyrenees development. The technical study was required to select the best development solution from the following options: new build FPSO, conversion of an existing FPSO, various FPU solutions (semi-submersible, TLP and ship-shaped hull). The scope included all the facilities from the mud-line up, that is, trees, flowlines, manifolds, risers, turret, mooring, swivel, vessel, topsides and detailed flow assurance studies. The final deliverable was the technical basis for the next phase, as well as CAPEX and OPEX estimates (± 25%) and project execution schedules. The cost estimates were based on industry quotations for all major equipment.
Gas Processing

WorleyParsons has designed and built more than 400 gas processing plants around the world. As such, we are responsible for much of the world’s gas processing capacity contributing to the processing of more than 250 billion SCFD. Our Select gas processing resources draw on this extensive experience to provide cost-effective solutions for our customers.

400+
Gas Processing Plants

250b
SCFD Capacity

60%
Of the World’s Recovered Sulphur Production

Our Select gas processing specialists can draw on over 60 years of experience and provide customized project solutions during the front-end phase of project development which leads to maximum value for our customers. The work undertaken by Select ranges from licensor selection, feasibility studies, pre-FEED definition to cost estimation and schedule planning. WorleyParsons is able to bring together experienced project people into teams to address specific gas processing requirements. Successful alliances with vendors and construction contractors have resulted in project cost savings as high as 40 percent.

WorleyParsons’ Select gas processing specialists have successfully managed unique problems arising from remote locations, hostile environments, overly sour gas streams and very high injection pressures.

Total Business Value Chain
Our specialists have a thorough understanding of the total business value chain including market analysis, financial modelling, technology selection, greenfield site selection, approvals management, new plant configuration, existing plant optimization and the development of detailed project realization methodologies. Select can be equally effective in supporting the decision making process for critical end-of-life planning issues when decommissioning projects.

Strategic Front-End Planning
Strategic front-end planning skills and extensive project execution capabilities, combined with WorleyParsons’ technological and commercial neutrality, differentiates Select as a market leader in the consulting market.

Jon Lewis
Global Director, Gas Processing
**Project: The Alaska Gas Pipeline LLC**  
**Customer:** Denali  
**Project Location:** North Slope, Alaska  
**Phases:**  
This was an essential part of the Denali project that involves the development of a gas treatment plant (GTP) located on the North Slope. Its purpose is to remove CO₂, H₂O, H₂S, and other impurities from the gas prior to pipeline delivery. The treatment plant will be the largest plant of its type in the world with process modules weighing up to 9,000 tons. Delivery of natural gas to the US and Canadian markets is expected to reach 4 billion ft³ per day. WorleyParsons’ Select team made use of its extensive resources and arctic experience to undertake the pre-front-end engineering and design (pre FEED) for the gas treatment plant. This showcased our knowledge and capability in the design and construction of mega projects in Alaska.

**Project: Khazzan Gas Field Development Project**  
**Customer:** BP  
**Project Location:** Oman  
**Phases:**  
This project is located in the Oman desert and comprises about 400 wells with a complex and extensive gas gathering system to a central processing plant with an approximate capacity of 1 bcf/d. Hydro-fracturing and treatment and disposal of process water necessitated the configuration of a complex water management solution. WorleyParsons’ Select used workshare services that allowed Canadian expertise to be used locally in Oman. This added value and increased the quality of the overall project. WorleyParsons’ Select gained valuable expertise in complex and extensive gas gathering systems and was able to use its zonal well pad development experience.

**Project: Buzzard Field Development**  
**Customer:** Nexen Petroleum U.K. Limited  
**Project Location:** UK North Sea  
**Phases:**  
This field’s production was from 27 production wells, and drilling was undertaken using a skid mounted jack-up rig located adjacent to the wellhead platform. Sweet gas was produced which fed the glycol dehydration and hydrocarbon dew point units. The acid gas stream was routed to the LP flare system. WorleyParsons’ Select team were responsible for the design of an acid gas removal unit (AGRU) used to process Buzzard associated sour gas offshore prior to transmission to an onshore facility. The design was based on the ExxonMobil Flexsorb® SE Hybrid solvent process that removes H₂S, mercaptans, and CO₂.
Heavy Oil & Oil Sands

Worldwide, WorleyParsons has over 40 years involvement in heavy oil projects including nearly all major commercial thermal facilities in Alberta, Canada. We have worked with heavy oil from 6° to 20° API.

- **40+ years experience**
- **15 commercial-scale SAGD plants**
- **$20B in SAGD capital designed**

Special methods are required to extract from new reservoirs or enhancing production from existing ones. WorleyParsons has designed nearly all the various types of heavy oil facilities including thermal recovery, water and miscible flood, chemical injection, gas injection, and downhole electric submersible pumps. Capabilities include central processing, field and cogeneration facilities.

Thermal techniques include cyclic steam stimulation (CSS), steam-assisted gravity drainage (SAGD), toe-to-heel air injection (THAI), solvent injection, and steam flood with other recovery processes. We have designed integrated thermal recovery facilities that can accommodate heavy oil with contaminants such as hydrogen sulphide, high paraffin content, asphaltenes, salt, sand, and other inorganics. We have also played key design roles in all of the operating mineable oil sands projects.

Paired with our EcoNomics™ capabilities, we offer solutions such issues as the management of contaminants, CO₂ sequestration, and water usage and disposal. EcoNomics™ is our enterprise wide framework that ensures profitable integration of environmental, social and financial sustainability into our customer’s projects and operating assets.

We have also helped design and develop many pilot plants for heavy oil customers. Some involved developmental technologies such as electro-thermal process, caustic and polymer flooding, enhanced thermal solvent, and vapour solvent extraction (VAPEX).

Whether using traditional methods or developmental techniques, our specialist experience and subject matter expertise can be applied to projects for enhanced oil recovery in any region of the world.

Mike Price
Global Director, Heavy Oil & Oil Sands
Project Marmul AK Field Polymer Flooding  
Customer PDO  
Project Location Oman  
Phases Identify Evaluate Define Execute Operate  
This project comprised a produced water treatment plant to treat 40,000 m³ of primary water and 30,000 m³ of secondary water per day.  
The scope of the work undertaken by WorleyParsons' Select team was based on proprietary data, and included the preliminary design of the polymer solution preparation and injection facility at the existing Marmul G station.

Project Christina Lake Phase 1, 2, 2B  
Customer MEG Energy  
Project Location Canada  
Phases Identify Evaluate Define Execute Operate  
WorleyParsons' Select completed the study, FEED and EP services for Phase 1 and 2 of this facility, including well pads and field facilities. Phase 1 is presently in commercial production and Phase 2 is to commence production shortly.  
WorleyParsons' Select has completed the FEED stage for Phase 2B and is currently working on the detailed engineering, including well pad and field facilities.

Project Joslyn North Mine  
Customer Total Exploration & Production  
Project Location Canada  
Phases Identify Evaluate Define Execute Operate  
WorleyParsons' Select is in the process of completing the basic engineering phase of the Joslyn North project. This phase followed the successful completion of the conceptual and DBM phases.  
The project's main components include ore preparation plant, bitumen froth production plant, froth treatment plant using pentane solvent including storage, froth settling units, solvent recovery unit, tailings solvent recovery unit, vent recovery unit and a depentanizer. The tailings processing lines include course, thickened, and froth treatment tailing, barges and dredges.  
Utilities and infrastructure facilities were also included.

Project Steepbank Extraction Plant  
Customer Suncor  
Project Location Canada  
Phases Identify Evaluate Define Execute Operate  
This project involves a new extraction plant to be based on the east side of the Athabasca River. This plant is to replace the aging base primary extraction plant.  
WorleyParsons' Select was asked to provide study, DBM, EDS and detailed engineering services for this grass roots project. The scope included hydro transport lines, two separation cells, four column flotation cells, as well as secondary and tertiary flotation cells.
Our Select LNG specialists understand that site selection and infrastructure requirements present the greatest factors of technical risk and uncertainty during the early development phases of an LNG project. Once these factors have been optimized, our technology specialists can focus on selecting the best LNG process for a specific development. Our early focus on these issues—combined with a unique technology neutral position in the industry—ensures that maximum value is realised from each opportunity.

As LNG projects become more complex and demanding, selection of the right technology becomes ever more important. WorleyParsons has adopted a technology neutral position in LNG to allow us to work with our customers to independently evaluate and select the most appropriate technologies for their projects.

WorleyParsons is in a unique position of being able to offer services across the entire LNG value chain, including the following:

- World scale greenfield LNG plants
- Brownfield optimization
- Offshore/Floating liquefaction and regasification facilities
- Onshore regasification plants
- Mid and mini LNG developments

**Baseload plants:** A combination of offshore and onshore capabilities allow us to optimize the entire development as well as selecting an appropriate liquefaction technology from the full range of available licensors. We can provide services such as strategic planning; opportunity evaluation; site, concept and technology; execution planning; and, the preparation of decision support packages.

**Brownfield optimization:** WorleyParsons understands the importance of maximizing production from existing LNG plants, and we have combined our asset services business with KBC to offer a unique asset optimization and development service. KBC are regarded as a market leader in assisting clients formulate long term strategic investment plans for their facilities and we are pleased to offer this service to our LNG clients.

**Offshore/Floating liquefaction and regasification facilities:** WorleyParsons has undertaken numerous studies of offshore and floating liquefaction and regasification facilities. Ranging from early feasibility studies through to full site-specific FEED projects they include novel solutions such as GBS based designs, nearshore and deepwater FLNG projects and reef based facilities.

**Onshore regasification plants:** WorleyParsons can provide early concept selection studies of onshore regasification facilities, terminals and tankage, through our centre of excellence in Teesside UK together with our High Value Engineering (HVE) centre in Mumbai.

**Mid and small scale developments:** This is a fast growing market segment and WorleyParsons can offer our clients assistance in developing cost effective packaged solutions using our extensive experience with module design and procurement.

Paul Sullivan
Global Director, LNG
**Project Singapore LNG Terminal**

**Customer** PowerGas  
**Project Location** Singapore  

To increase the security of Singapore’s domestic gas supply, PowerGas is constructing the nation’s first LNG regasification terminal on Jurong Island.

WorleyParsons’ Select was asked to provide the basis of design and the front-end engineering design (FEED). This work includes development of the EPC contractor tender documents and subsequent evaluation and recommendations. WorleyParsons’ expertise in hydrocarbons, power and infrastructure together with a 20 year history in Singapore, as well as a global process capability are critical to the success of this important project.
Offshore Topsides

Select draws on WorleyParsons experience in delivering topsides from the smallest wellhead platform to the largest integrated floatover deck. This experience, combined with our unique offshore toolkit, enables us to rapidly define feasible options and select the best case to provide our clients with maximum value.

As offshore facilities move to deeper waters and more extreme climatic conditions, selection of the right facility concept and topsides becomes even more important.

WorleyParsons has developed a design tool to quickly evaluate costs of hundreds of topside options and select the most optimal solution for the facility.

The offshore industry is moving into ever deeper and more challenging environments. Select has been at the forefront of these developments with our industry leading designs for deepwater facilities, standardized wellhead designs, arctic topsides and large integrated floatover decks.

Select is an integral part of the WorleyParsons global project delivery capability that assists customers by bringing together high-end technical skills with extensive practical experience in project execution to deliver best in class front end studies.

WorleyParsons has a diverse range of global skills that provides Select access to experience gained from new field development across a range of locations and environments. Our brownfields experience from involvement in over 35 long-term service contracts, enables us to help our customers to cost effectively maximize and maintain asset value.

Select can draw on the available experience from within the WorleyParsons Group to provide strategic advice and financial analysis for projects early in the development cycle. Select provides services to asset owners, operators and investors, using WorleyParsons’ real world experience in total project delivery, asset operation and industry best practice. This capability enables customers to be confident that the critical decisions, made in the conceptual stages of a project, will support their ultimate business objectives. In all areas of expertise, Select offers our customers unparalleled access to:

- A diverse and experienced offshore topsides design team, many of whom are leaders in their field
- Strong technical competencies providing extensive front-end value adding opportunities for topside design
- A focus that matches the customer’s business objectives with the underlying economics of the market and region
- Innovative and creative thinkers able to identify, evaluate and pursue strategic opportunities.

**Paul Dragovic**
Global Director, Offshore Topsides
Project Browse Basin Development  
Customer Woodside Energy Ltd  
Project Location Western Australia  
Phases  

The Browse basin field lies 300km offshore from Western Australia in a water depth of 400 meters. The gas reserves are considered high enough to support a dedicated LNG facility.

Select has been assisting Woodside in determining the best development scenario to meet its business objectives. Possible developments that were considered included gas export to a new onshore LNG facilities in either Darwin or the Kimberley, transport to the existing LNG facilities on the Burrup or possible offshore LNG options including floating facilities or fixed offshore structures in neighboring shallow water.

Project Jasmine Area Development Project  
Customer ConocoPhillips  
Project Location Central North Sea, UK  
Phases  

The Jasmine development comprises a new wellhead platform tied back to the Judy platform via a new multiphase pipeline and new riser platform, bridge linked to the existing Judy platform. The Jasmine wellhead platform includes a test separator, flare, metering and will be supported by a new bridge-linked living quarters platform.

WorleyParsons has been engaged by ConocoPhillips (as Operator) and their joint venture partners, BG and ENI, to carry out FEL 2, FEL 3, detailed design and procurement services to develop the Jasmine field.

Project Platong Gas II Development Project  
Customer Chevron  
Project Location Thailand  
Phases  

Platong is in the Gulf of Thailand, and this project was to provide an expansion to the existing complex. It involved installing a new gas processing platform (PLCPP2) and a new 200 bed living quarters (PLLQ2) platform. A bridge links both platforms to the existing facilities. A new flare platform was also installed and the entire project was undertaken in a water depth of 70+ meters.

The topsides for PLCPP2 had an installation weight of around 18,500 tonne and were installed using the float over method. This is the first time this installation technique was used by Chevron in the Gulf of Thailand. The WorleyParsons scope covered the conceptual engineering during Select Phase, FEED and procurement services, including the purchase of long lead equipment.

Project Bressay Facility Concept Study  
Customer Statoil  
Project Location North Sea, UK  
Phases  

Bressay is a heavy-oil field located, offshore, east of the Shetland Islands on the UK Continental Shelf in a water depth of about 105 meters. The field is to be developed with an independent standalone facility. It will include an integrated process, drilling and quarter (PDQ) topside on a fixed steel jacket substructure. Stable oil will be exported in traditional shuttle tankers via one floating storage unit.

WorleyParsons’ Select will undertake the concept study comprising the complete Bressay PDQ platform.
Onshore Developments

With much of the world’s easy to produce oil already recovered, WorleyParsons increasingly assists customers on projects employing a range of secondary and tertiary Enhanced Recovery (ER) techniques.

These techniques can be used to produce oil from new reservoirs that cannot produce by natural drive, or to enable additional production from existing reservoirs after primary production methods have been employed. Select can tap into WorleyParsons’ more than 30 years experience undertaking ER projects. Our recent project work covers all the following major categories within the secondary and tertiary ER classes.

**Waterflood**
Water is injected into the reservoir formation to displace residual oil. The injection water physically sweeps the displaced oil to adjacent production wells.

**Gas lift**
Gas is injected into the production tubing to reduce the hydrostatic pressure of the fluid column resulting in a reduction in bottom hole pressure allowing the reservoir liquids to enter the well bore at a higher flow rate.

**Electrical submersible pumps (ESP)**
ESPs have now become the default method of artificial lift within many of the major oil producing regions. It is the associated electrical infrastructure that defines an ESP project.

**Thermal recovery**
Heat - such as the injection of steam, hot solvent or in situ combustion - is introduced to lower the oil viscosity and improve its ability to flow through the reservoir.

**Gas injection**
Gases such as natural gas, nitrogen, or increasingly, carbon dioxide, are injected into the reservoir. Under the right conditions, the gas acts to lower viscosity and improve flow rate, pushing trapped oil (and in selected cases, gas) to a production well bore.

**Chemical injection**
Long-chained molecules (polymers) or surfactants are introduced to increase the effectiveness of waterflood projects. These chemicals improve volumetric sweep, efficiency and reduce channelling and breakthrough.

Andy Cole
Senior Vice President, Hydrocarbons
Project Nimr C Field - Water Flooding  
Customer PDO  
Project Location Oman  
Phases [IDENTIFY] [EVALUATE] [DEFINE] [EXECUTE] [OPERATE]  

This project involves a new gathering station in the Nimr C field designed to separate free water and associated gas from the gross production received from Nimr C and Nimr D fields. Produced water is used for water injection wells and oil water emulsion is sent for further processing to the Nimr production station.

The scope of the work undertaken by WorleyParsons’ Select team included the gathering pipelines, separation and treatment facilities, associated utilities and the injection water pumping and distribution systems.

Project Gas Lift Facilities Upgrade  
Customer KOC  
Project Location Kuwait  
Phases [IDENTIFY] [EVALUATE] [DEFINE] [EXECUTE] [OPERATE]  

This was a series of projects undertaken to provide new booster stations and interconnecting lines in northern Kuwait. The scope of each project included the installation of additional low and high pressure gas compression, dehydration facilities, interconnecting pipeline systems and the associated tie-in to an existing gas lift network.

WorleyParsons’ Select carried out the feasibility study and FEED before undertaking the role of PMC over the EPC Contractor.

Project Surmont Project  
Customer ConocoPhillips/Total  
Project Location Canada  
Phases [IDENTIFY] [EVALUATE] [DEFINE] [EXECUTE] [OPERATE]  

ConocoPhillips/Total engaged WorleyParsons’ Select to conduct the FEED for an in situ expandable oil sands plant producing 22,500 bpd of bitumen from the Surmont lease using steam assisted gravity drainage (SAGD) technology. Prime FEED deliverables included the basis of design memorandum, the project execution plan and a ± 10% cost estimate.

Project Second Generation and Sour Gas Injection Projects  
Customer Tengizchevroil  
Project Location Kazakhstan  
Phases [IDENTIFY] [EVALUATE] [DEFINE] [EXECUTE] [OPERATE]  

The purpose of the second generation project—incorporating the sour gas injection project—is to expand oil and gas handling facilities from 12 to 22 MM tonne per year. The project is located in the Caspian Sea in Kazakhstan.

With joint venture partners, WorleyParsons’ Select process design work included the detailing of facilities for oil and gas separation, oil stabilization, gas treating/conditioning/polishing, sour gas injection, LPG recovery and polishing, sulfur recovery and tail gas treatment and acid gas injection.
Petrochemicals

In the early phases of a petrochemical project Select focuses on the key aspects of licensor selection and facility integration. This together with an holistic view of offsite optimization and reliability enables Select to bring a new level of performance to our clients facilities.

Select brings real world experience into the front-end value-adding phases to maximize investment return and underlying confidence. By focusing on a project’s critical early phases, Select can add technical definition to reduce risk, optimize opportunity, and maximize the inherent value of the project. Select can assist customers to create a business case, assess lifecycle costs, secure the necessary approvals, and prepare for the next phase of the project.

Petrochemical projects generally have the highest margins of error within the hydrocarbons industry, which is a result of the many products and product grades and the complexities of the process units for the purest of hydrocarbons chemicals. Select’s petrochemicals specialists have practical experience designing and operating these complex facilities, and have a thorough understanding of the total business value chain. This first-hand knowledge, leveraged with global resources, allows WorleyParsons’ Select to increase certainty of project outcomes and allow customers to make profitable decisions with confidence.

Select conducts market analysis, financial modelling, technology selection, greenfield site selection, approvals management, new plant configuration, existing plant optimizations, and develops detailed project realization methodologies. These strategic front-end planning skills and services, integrated with extensive project execution capabilities and Select’s technological and commercial neutrality, differentiate us for our customers’ benefit. Our petrochemicals experts remain educated on a wide range of technologies which permits Select to objectively advise on technology selection and provide optimal project outcomes.

John Barnhart
Global Director, Petrochemicals
Project Confidential  
Customer Confidential  
Project Location Latin America  
Phases

This project was the first petrochemicals project undertaken by this customer and had a TIC of US$4.37 billion. The customer sought to increase petrochemical output using local refinery and natural gas feedstocks, and supply products to the Latin American market. WorleyParsons’ Select was chosen to coordinate the execution of the conceptual engineering phase, to manage the technology licensor selection process, and to support the generation of a +30% capital cost estimate. The development of a parallel estimate resulted in significant potential savings and cost reductions, and a positive approval decision.

Project Chevron Texaco PCEP  
Customer Chevron  
Project Location Pascagoula, Mississippi, United States  
Phases

This project was for a feasibility study into the development of an integrated gasification combined cycle (IGCC) cogeneration plant at the site of the Pascagoula refinery using the proprietary gasification technology licensed by an affiliate of Chevron Texaco. WorleyParsons’ Select looked at the feasibility of building a reliable and efficient IGCC plant that used petroleum coke in an environmentally friendly manner to produce high value end products such as hydrogen, power, and steam, while reducing the operating expenses of the refinery.

Project Linear Alkyl Benzene  
Customer Venoco / PDVSA  
Project Location Venezuela  
Phases

PDVSA and Venoco, a Venezuelan chemical company, examined the potential of using refinery aromatics to produce linear alkyl benzene. This was one of very few projects to be partially funded by the US Trade Development Agency. WorleyParsons’ Select conducted a licensor evaluation and completed a project scope definition package that included preliminary P&IDs. The execution involved multiple entities as stakeholders and was carried out in a number of countries. Following the completion of a cost estimate, a whole of project economic analysis was conducted.

This project was completed ahead of schedule and under budget; although, the outcome is now pending due to political uncertainty.

Project MMA-ACN Chain Project  
Customer SABIC  
Project Location Jubail, Saudi Arabia  
Phases

SABIC engaged WorleyParsons to undertake pre-FEED feasibility project development studies, including licensor evaluation, utility and offsite definition, logistics, and port facilities. The evaluation of site layout options, within existing SABIC manufacturing affiliates, was completed and WorleyParsons has since continued to support the Deliver phase by developing FEED packages making use of our Beijing and Singapore offices.

Select Hydrocarbons Capability & Experience  | 23
Pipeline Systems

Pipeline experience gained from working in a variety of regions and environments has enabled WorleyParsons to develop an extensive database of knowledge that Select engineers can use to help our clients maximise their business outcomes.

Select is an integral part of the WorleyParsons global hydrocarbons project delivery capability. Select provides pre-FEED services to asset owners, operators, and investors by making use of WorleyParsons’ extensive real-world experience in total project delivery, asset operation, and industry best practice.

These services enable customers to be confident that the critical decisions made in the conceptual stages of a project will satisfy their ultimate business objectives. Specific areas of expertise associated with pipeline projects include:

- **Greenfield project development planning** – Select provides sustainable project development scenarios to further customers’ decisions for the most applicable business case.

- **Brownfield field development planning** – Select applies current operational know-how to deliver cost-effective increases in capacity that maximizes whole-of-life returns from existing assets.

- **Financial and economic analysis** – Select accesses the global database of major capital projects within WorleyParsons, enabling customers to support their strategic investment decisions with accurate and reliable development planning data.

- **Compressor/pump station spacing** – includes optimization against pipeline diameter and allowance for future expansion scenarios.

- **Route selection** - includes automated route selection software which balances out all competing criteria using defined weightings.

- **Pipeline permits and approvals** – Select provides significant knowledge of the pipeline permits and approvals required in many different regions due to our strong environmental capability and geographic coverage.

Peter Cox
Global Director, Pipeline Systems

50+
Select personnel

Cost estimates for projects from
20K-20B
total installed cost
**Project** Mackenzie Gas  
**Customer** Imperial Oil Resources Ventures Ltd.  
**Project Location** Canada  
**Phases** Identify, Evaluate, Define, Execute, Operate

The Mackenzie Gas project comprises an integrated pipeline facility designed to collect natural gas from producers in the Arctic Mackenzie Delta and deliver it to receiving pipelines in Alberta. The facilities include production pads at three locations, compressor stations, a gathering system, a process plant, 12-inch liquids pipeline to Norman Wells, and a 30-inch natural gas mainline running south to the Alberta border. The total length of the pipeline system will be about 1,200 km. WorleyParsons’ Select was asked to develop the conceptual design and provide technical input into the required regulatory permit applications. The conceptual design included the selection of pipe sizes and operating pressures and temperatures for the pipeline as well as the associated compression facilities.

---

**Project** Iran-Pakistan Gas Pipeline  
**Customer** BHP Billiton/NIGEC  
**Project Location** Iran, Pakistan, and India  
**Phases** Identify, Evaluate, Define, Execute, Operate

WorleyParsons, through the APE joint venture, completed the pre-feasibility study on the 2,600 km gas import pipeline taking South Pars gas to major consumption centers in Iran, Pakistan, and India. The study report defined the development and refinement of selected pipeline options and estimated costs plus associated project technical and logistical implementation strategies. BHP Billiton recently requested an update to the study to include increased gas demand and a possible extension of the pipeline through to China as the project continues to gain momentum.

---

**Project** Gateway Pipeline  
**Customer** Enbridge Pipelines Inc.  
**Project Location** Canada  
**Phases** Identify, Evaluate, Define, Execute, Operate

This project included a FEED study for Enbridge Pipelines Inc. that encompassed engineering services to support regulatory applications for the construction of a greenfield crude oil and diluent pipeline system from Edmonton, Alberta to a marine terminal located in Kitimat, BC. The pipeline will transport crude oil in a 30-inch diameter pipeline with a design capacity of 400 K bpd. The 1,160 km crude oil pipeline will be paired with a new 16-inch diluent pipeline to carry 150 K bpd to Edmonton. Terminals at Edmonton and Kitimat will have 21 crude tanks and eight condensate tanks. Other pipeline facilities include marine top works facilities at Kitimat to load oil tankers and unload condensate tankers.

---

**Project** Feasibility Study – Fuel Pipeline and Storage Facility  
**Customer** Venessia Petroleum  
**Project Location** Mozambique  
**Phases** Identify, Evaluate, Define, Execute, Operate

Malawi is a land-locked country with no oil and gas resources. As a result, all fuel must be imported using truck and rail tankers. WorleyParsons’ Select studied the feasibility of importing fuel through a new pipeline that included petrol, jet A1, illuminating kerosene, and diesel, batched through a single pipeline from an import terminal to a road and rail tanker distribution terminal in Malawi. The pipeline design capacity was 1.781 m³/day. The project also included five new storage tanks with a total storage capacity of 36,600 m³ at Beira plus nine new storage tanks at Nsanje with a total storage capacity of 163,000 m³.
Refining

Decisions made during the initial stages of a project have the greatest impact on the ultimate business outcome.

80 revamps in the past 15 years

Utilizing our extensive experience in total project delivery, asset operation and industry best practice, Select provides pre-FEED (Phase 1 and 2) services to asset owners, operators and investors.

Greenfield development
Refining modelling, strategic planning, opportunity evaluation, concept selection and technology selection.

Brownfield optimization
Deliver cost effective increases in production to deliver whole-of-life return from existing facilities.

Strategic advice and financial analysis
Select can offer strategic advice to asset owners that is based on a thorough understanding of the refining business and its value chain. Select can also offer investment advice with accurate and reliable development costs and schedule data. The early (pre-FEED) stage of any project must provide the key decision support packages needed to decrease risk and provide the economic basis to attain project sanction. For refining projects this early stage work typically includes:

- LP and Nonlinear modelling
- Technology overviews
- Refinery optimization
- Execution planning
- Refinery configuration studies
- Risk assessments
- Regulatory compliance
- Licensor Evaluation and Selection

Strategic alliance with KBC for refinery configuration and efficiency studies

Decisions made during the initial stages of a project have the greatest impact on the ultimate business outcome.

Helmy Andrawis
Global Director, Refining
Select Hydrocarbons Capability & Experience

**Project: Voyageur Upgrade Hydrotreater Project**  
**Customer:** Suncor  
**Project Location:** Canada  
**Phases:** Identify > Evaluate > Define > Execute > Operate  

The Voyageur Upgrader project (VUP) comprised the delivery, upgrading, marketing and infrastructure growth required to increase the total Suncor oil sands production capability from 357 KBPCD in 2008 (post Millennium Coker Unit start-up) to 550 KBPCD by 2010 to 2012.

WorleyParsons’ Select was responsible for the EDS and detail phase engineering and procurement for the Voyageur upgrader UOP hydrotreating units, HTUs (coker gasoil, coker diesel and coker naphtha). The HTUs process all the Voyageur Upgrader delayed coker side streams to reduce product sulfur, nitrogen, and aromatics content. HTU catalyst beds and operations were optimized to obtain 30 months between bed replacements.

**Project: Refinery Expansion and Revamp**  
**Customer:** Consumer Co-operatives Refineries Ltd  
**Project Location:** Saskatchewan, Canada  
**Phases:** Identify > Evaluate > Define > Execute > Operate  

WorleyParsons performed the FEED and is currently executing EPCM services for this refinery expansion and revamp with the goal of processing synthetic crude from Athabasca bitumen. WorleyParsons is responsible for all the major process units, including the naphtha and distillate hydrotreating units (Axens and UOP), and is working very closely with the licensors to optimize the design and process simulations. Significant innovation and cost savings (over US$50 million) including energy optimization were developed and implemented by WorleyParsons. This is a US$1.9 billion expansion project, for which WorleyParsons was chosen to provide full project delivery including engineering, project controls, information management, document control, procurement support, and construction management.

**Project: Genesis**  
**Customer:** Suncor  
**Project Location:** Ontario, Canada  
**Phases:** Identify > Evaluate > Define > Execute > Operate  

WorleyParsons’ project objective was the revamp of existing facilities and the addition of new facilities to permit the refinery to process sour crudes from Suncor’s oil sands operations and to meet new sulphur content legislation. The feasibility study was performed for the entire project along with the development of the DBM, EDS, and detailed engineering for the revamp portions of the project. During the feasibility study phase, WorleyParsons worked with Suncor in developing the overall project scope and capital cost estimates, performing screening studies and selecting technologies for hydrotreating, hydrocracking, sulphur, and tail gas units.

**Project: Gdansk Refinery SRU**  
**Customer:** Grupo Lotos  
**Project Location:** Poland  
**Phases:** Identify > Evaluate > Define > Execute > Operate  

This major project used WorleyParsons’ sulphur removal technology and was engineered, constructed and commissioned by WorleyParsons. This project was implemented at the Rafineria Gdanska in Northern Poland. WorleyParsons scope of work covered the entire project from the provision of technology through detailed design, procurement, construction management, commissioning and start-up assistance and included operator training. The sulphur plant consists of two 60 tpd Claus units and a single train Beavon sulphur removal (BSR) plant.
Sulphur Technology

The selection of a robust and cost effective Sulphur Technology concept is critical to the financial success of a project.

Identify Phase
Initial development of a project’s requirements can be rapidly assessed by our Select team of consultants. The Identify phase provides direction at a high level to ‘identify’ technically feasible solutions that can be integrated into the overall project. This assessment could include recovery and emissions requirements, capacity limitation, plot space as well as power and control integration. The assessment is made at a high level to provide adequate technical input, cost, scheduling and execution planning.

Evaluate Phase
Following the Identify phase, a more encompassing review is required, and this can be undertaken using our Select tools and team of consultants. This development of each project seeks to maximize value and deal with the complexities relating to and its removal and disposal, including integration into customer facilities. Project developments are often analysed using EcoNomics™, which assists our customers in adopting a broader view of the impacts of their operations and incorporates financial, social and environmental risk into their project decisions to deliver optimized and profitable solutions. This process allows a detailed sensitivity analysis of project factors to help first determine the main cost drivers and secondly to optimize these drivers. This initiative helps Select deliver projects to our customers that are future-proofed with improved risk management.

On completion of the select phase a single process scheme will be recommended and presented, complete with detailed cost and schedule justification, to the phase gate approval.

Angie Slavens
Global Director, Sulphur Technology

600+ sulphur plants designed

using our EcoNomics™ delta tool a full picture of commercial drivers and project sensitivities are obtained
<table>
<thead>
<tr>
<th>Project</th>
<th>Hannibal Sour Gas Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>BG Tunisia</td>
</tr>
<tr>
<td>Project Location</td>
<td>Sfax, Tunisia</td>
</tr>
<tr>
<td>Phases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Miskar gas field is located offshore from Tunisia. Gas from the field is processed at the Hannibal Sour Gas Plant, Tunisia. Six additional infill wells are being drilled to extend the Miskar field production plateau, resulting in an increased duty on the gas plant’s processing equipment, primarily the acid gas removal (AGR) and the sulfur recovery. Initial studies were undertaken to de-bottleneck or replace these existing facilities to process the increased quantity of H₂S and convert it to a saleable by-product. The studies concluded the following stages of revamp requirements: upgrade of Amine Contactor columns internals, replacement of the amine stripper columns, additional inlet gas filter coalescer, new hot oil indirect amine re-boil system and new sulfuric acid plant and export facilities.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project</th>
<th>Sullom Voe Terminal (SVT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>BP</td>
</tr>
<tr>
<td>Project Location</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Phases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Sullom Voe Terminal (SVT), located in the Shetland Islands, UK, has existing H₂S removal facilities to treat the associated gas from the West of Shetland offshore platforms before being exported to Magnus for EOR. The gas from these WOS platforms is steadily increasing in H₂S concentration and modifications to the facilities needed to be studied before upgrading. WorleyParsons studied in detail the technical solutions and Economics™ of replacing or upgrading existing non-regenerable Puraspec units and concluded that the best value solution was to upgrade with an ultra high-pressure (180 barg) Amine Removal Unit followed by TEG dehydration and acid gas disposed of via incineration of H₂S to SO₂ followed by sea water scrubbing of the SO₂.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project</th>
<th>Smelter Flue Management Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>Vale Inco Copper Cliff</td>
</tr>
<tr>
<td>Project Location</td>
<td>Canada</td>
</tr>
<tr>
<td>Phases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WorleyParsons worked closely with Vale Inco on a study to define existing gas conditions throughout the converter, MPV, and anode furnace ESP systems and to develop options to improve emissions capture, reduce air infiltration, prevent acid condensation and corrosion, and reduce stack reheat burner fuel consumption. WorleyParsons also performed a benchmarking study with Vale Inco that evaluated SO₂ removal technologies used at various smelters around the world including scrubbing, acid plants and liquid SO₄ plants.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project</th>
<th>Low-BTU Gas Utilization Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>Saudi Aramco</td>
</tr>
<tr>
<td>Project Location</td>
<td>Kingdom of Saudi Arabia</td>
</tr>
<tr>
<td>Phases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WorleyParsons investigated options for producing power and desalinated water, using 900 MMSCFD of low-BTU, sour, non-associated gas, in order to meet increasing domestic energy demands and environmental regulations. The study specifically looked at post-combustion treatment options, whereby the sour gas would be burned directly, without sweetening, and the resulting sulphur dioxide recovered from the flue gas. The first study was a combined cycle configuration, in which the feed gas is burner in a gas turbine, generating some power, and then the hot exhaust gas is used to generate high-pressure steam, which is used to generate more power. The second was a utility boiler configuration, in which the feed gas is burned in a traditional utility-type boiler to produce high pressure steam which was then used to generate power.</td>
</tr>
</tbody>
</table>
Unconventional Oil & Gas

Select provides customers with optimal solutions that consider the full spectrum of project constraints and opportunities.

Recognizing the importance of early project risk assessments to help define scope and priority areas while achieving alignment, WorleyParsons integrates non-technical risk considerations into concept development.

Over the years, WorleyParsons’ hydrocarbons, infrastructure and environmental sector specialists and engineers have accumulated a great deal of expertise which Select can access to provide our customers with comprehensive front-end analysis of unconventional oil and gas projects. The Select team can critically assess the project, address respective opportunities and constraints, and provide an initial conceptual scope for project execution. Critically, the scope must be able to operate safely, simply, and over a wide range of operating variables. Major areas offered by Select for unconventional oil and gas developments include the following.

Advice and Consultation
- Assessment of social and environmental impacts, including planning and optimization of land use.
- Provision of support and advice in securing community and regulatory stakeholder approvals.

Procurement, Logistics and Construction Management Services
- Plan development for field exploitation, including activity integration such as road routing, production aggregation, centralized processing and export sales pipelines.
- Development of a total water management plan to support both drilling needs (water sourcing) through to produced water treatment.
- Design, procurement and deployment of fit-for-purpose production assets within the complex environment of simultaneous drilling, construction and operations activities.

The need for strategic planning and logistics is greatly multiplied when producing unconventional oil and gas due to the increase in required wells, the variability among the well streams and sales streams, environmental concerns, and the number of simultaneous activities for wells, gathering systems, and process systems. Select can combine our unique experience and strategic relationships in power, infrastructure, water, and hydrocarbons to coordinate these added complexities.

The results will be analyzed via our EcoNomics™ trained project team that designs for business, environmental, and social sustainability from the outset. These teams are supported by WorleyParsons’ formally embedded systems and procedures, proprietary software, sustainability training, and a global network of leading engineering and technology capabilities.

Dan McGinnis
Global Director, Unconventional Oil & Gas
Project **APLNG Environmental Impact Statement**
Customer **Australia Pacific LNG**
Project Location **Queensland, Australia**
Phases [IDENTIFY] [EVALUATE] [DEFINE] [EXECUTE] [OPERATE]

APLNG involves the development of substantial coal seam gas (CSG) resources, has an expected life of at least 30 years and capital costs of A$35 billion through 2020. It will incorporate 10,000 gas wells, 520 km of pipeline, and an LNG facility. WorleyParsons was commissioned to prepare an Environmental Impact Statement (EIS) for APLNG and introduced the first basin-wide assessment of potential cumulative impacts to groundwater, and provided a comprehensive assessment of all credible CSG water use options, based on the proprietary EcoNomics™ modeling tool. The EIS was delivered on time (<10 months), within agreed budget, with positive feedback from regulators, and no requirement to submit a formal Supplementary EIS.

---

Project **BP Oman Khazzan**
Customer **BP**
Project Location **Oman**
Phases [IDENTIFY] [EVALUATE] [DEFINE] [EXECUTE] [OPERATE]

BP engaged WorleyParsons to conduct the conceptual engineering, pre-FEED and FEED for the Khazzan-Makarem gas field development, a tight gas field in Oman. A range of development options were evaluated for this US$5 billion capital investment and the preferred option was further engineered to provide a solid foundation for the FEED. The development will produce gas and condensate which will be processed to deliver 1,200 MMscfd of sales gas added to associated condensate. The field will include between 300 and 400 well pads, a 500 km gathering system, a 1.2 bcfd gas processing plant, and export tie-in lines. WorleyParsons will use its expertise in other industry sectors to deliver all infrastructure needs, such as power, telecommunications, roads, and water and wastewater facilities to support each project phase.

---

Project **Arrow LNG Plant Project**
Customer **Arrow Energy (Shell / CNPC Joint Venture)**
Project Location **Queensland, Australia**
Phases [IDENTIFY] [EVALUATE] [DEFINE] [EXECUTE] [OPERATE]

Arrow Energy has undertaken a CSG to LNG project that consists of several integrated projects including 2 x 4 mtpa LNG trains, the development of the Surat and Bowen Basin CSG fields, two major pipelines, and power infrastructure. Familiar with the complex and linked effects of technology/concept selection, project delivery, and social and environmental aspects, WorleyParsons will identify the optimal solution for the development of the Surat Gas Project and provide sufficient analysis to progress through decision-making gates and commence FEED. The studies, due for completion in 2012, will include reviews of the production wellheads, low/medium pressure gathering systems, field and central compression facilities, water management, modularization, project execution strategy and operations.

---

Project **Central European Resource Play**
Customer **Confidential**
Project Location **Central Europe**
Phases [IDENTIFY] [EVALUATE] [DEFINE] [EXECUTE] [OPERATE]

WorleyParsons is conducting a study for the exploration, potential appraisal, and development of a shale resource play in Central Europe. The execution of this play will require a low profile installation and the flexibility to accommodate new regulations or changing conditions in the chosen plan. Using a fit-for-purpose country-specific approach, the study incorporates technical, economic, environmental, water management, and logistical objectives; and various scenarios are being investigated for production rates, numbers of rigs, wells per pad, and fluid transportation options. Focused on sustainability and socio-economic benefits, WorleyParsons is working with local environmental groups to determine restrictions and effects to the community, the country, and the customer from drilling, fracking, and production.
Field Development Planning

*Select*, in combination with our wholly owned partner INTECSEA, offers customers a single integrated project delivery service from wellhead to market for the most challenging hydrocarbon developments. We understand that a successful development scenario needs to be not only technically strong but also robust to deal with the many risks and uncertainties that come with making key decisions during the earliest phases of project development.

- Techno-economic appraisal
- End-to-end flow assurance
- Fixed and floating structures
- Subsea, topsides and onshore facilities
- Multi criteria site screening analysis

*Select* specializes in working with clients to frame and screen full field development options and to evaluate these options using a suite of efficient and transparent tools from an economic and suitability perspective. *Select* uses a disciplined and structured decision making process that firstly ensures a broad enough range of realistic concepts are considered before rapidly narrowing down to the preferred case by using predetermined selection criteria. Our *Select* toolkit is a system used by concept teams to generate and rank realistic development cases and includes:

- Project alignment and framing workshops
- *SeleXpress* - for developing complete process designs, equipment lists, module weight estimates and various load lists
- *Selego* - a building block based cost estimating tool
- *Selector* - for rapidly assessing multiple cost estimates to provide our customers with a clear and concise understanding of the where and why casvary
- *SelectNES* and DELTA™ - to allow the potential impact of financial and non-financial uncertainties to be evaluated across multiple development scenarios
- Assurance packages - a key deliverable of a *Select* phase project is the assurance package that covers both cost and schedule. Utilizing our database of recent projects and our access to the WorleyParsons Deliver organization we are able to give customers assurance that leading edge projects can be delivered within the cost and schedule boundaries estimated during the *Select* phase.

Geeta Thakorlal
Regional Director, Field Development Planning
### Project: Rospan Development Concept Study  
**Customer:** TNK-BP  
**Project Location:** Russkoye Field, Siberia, Russia  
**Phases:**  
WorleyParsons was contracted to undertake a heavy oil full field development concept study which supersedes the initial study by SNC Lavalin. The first phase of the study includes options analysis while the second phase includes concept definition, generation of a CAPEX estimate, basis of design and scheme of work. Work share was implemented with WorleyParsons’ office in Calgary for heavy oil expertise as well as with a local Russian design institute - TERM. Challenges included gaining a better understanding of TNK-BPs and subsidiary Rospan’s approach to field development planning, and working with on-site subcontractors responsible for executing several of the utility and infrastructure based studies.

### Project: Gas Master Plan  
**Customer:** Nigerian National Petroleum Corporation  
**Project Location:** Nigeria  
**Phases:**  
As part of Nigeria’s resolve to harness associated gas and non-associated gas for utilization of the country’s growing utilities and power infrastructure, a Nigerian Gas Master Plan was undertaken. The Master Plan was aimed at growing the Nigerian economy with gas by pursuing three key strategies: to stimulate the multiplier effect of gas in the domestic economy, to position Nigeria competitively in high value NGL export markets and to guarantee the long term energy security of Nigeria. WorleyParsons was contracted to perform program planning and schedule development.

### Project: Wheatstone  
**Customer:** Chevron Australia  
**Project Location:** North West Shelf, Australia  
**Phases:**  
WorleyParsons' involvement in the Wheatstone project started in the earliest stages of concept selection, for all upstream offshore and onshore facilities to process gas from the Wheatstone and Lago gas fields.

Extensive studies were undertaken to consider all of the development alternatives available for the opportunity, including joint venture opportunities, 3rd party tie-backs, offshore gathering facilities and various locations along the Pilbara coast for stand alone plants. Plant types considered included both LNG and GTL as well as associated Domestic Gas facilities.

### Project: Alaska North Slope Renewal Program  
**Customer:** BP Exploration Alaska  
**Project Location:** North Slope, Alaska  
**Phases:**  
The North Slope renewal program included BP’s Greater Prudhoe Bay (GPB) and Milne Point (MP) assets. GPB is a US$30 billion asset that covers 360 sq. miles and includes 1,300 wells, 45 well pads and seven production facilities producing 286,000 barrels of oil and 10 billion standard cubic feet of gas per day. The renewal program was established to determine the facility and infrastructure requirements for the next 50 years of operation and prepare a long term development plan. Studies undertaken by WorleyParsons’ Select business line included an assessment to determine the condition of the processing facilities and infrastructure to create a baseline for redevelopment options, as well as cost estimates for the conceptual modifications and expansions. WorleyParsons’ Select used concept of building blocks to develop a method that would effectively assess both the brownfield and greenfield development cases efficiently and reliably.

### Select Hydrocarbons Capability & Experience

---

[Image of maps and locations related to projects]
EcoNomics™ Assessment

WorleyParsons provides customers with strategic decision making support by quantifying the environmental, social and economic sustainability of project options across the asset life-cycle.

1

common metric
for comparing all
solutions - money

$3bn

in environmental, social and
financial value added from
approved decision making

150+

EcoNomics™ assessments
completed on projects
worldwide

EcoNomics™ Assessment is a unique process which establishes global best practice for integrating sustainability into project decision-making. By quantitatively examining a full range of financial, environmental and social issues relevant to the project, real economic optima can be identified, which maximizes profit while ensuring enhanced long-term sustainability.

We work closely with our customers in a formal framing workshop to agree on the key project objectives, identify project options, and determine the financial and external assets to be assessed and risks to be evaluated.

EcoNomics™ Assessment incorporates elements of life-cycle analysis risk assessment, cost benefit analysis and decision theory in a software toolset (EcoNomics™ DELTΔ™). All elements of interest are quantified physically, monetized, and reduced to a clear NPV ranking through the use of comprehensive sensitivity analysis. DELTΔ™ can accommodate a full range of financial parameters, social issues (health, safety, heritage and cultural value) and a full range of environmental factors (water, biodiversity, air and water emissions, greenhouse gases). The inter-relationships between all factors are examined in a common unit (money) to identify optimal choices over a wide range of possible future conditions.

Option comparison on full EcoNomic NPV over the asset life cycle.

Identifying the best option over all possible combinations of variables.
Our Vision

WorleyParsons will be the preferred global provider of technical, project and operational support services to our customers, using the distinctive WorleyParsons’ culture to create value for them and prosperity for our people.

Leadership
- Committed, empowered and rewarded people
- EcoNomics™ – Delivering profitable sustainability
- Integrity in all aspects of business
- Energy and excitement
- Minimum bureaucracy

Agility
- Smallest assignment to world-scale developments
- Local capability with global leverage
- Responsive to customer preferences
- Optimum solutions customized to needs

Relationships
- Rapport with all stakeholders
- Open and respectful
- Collaborative approach to business

Performance
- Zero harm
- Results for our customers and employees
- Creating wealth for our shareholders
- World-class resources, capability, and experience
For further information about our global capability, email select@worleyparsons.com