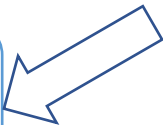


**Field Development  
Capability Statement**



**Growing Reliable Partnership**

Technical Training	<b>Field Development</b>	Subsea Systems	Subsea Pipelines	Floating Structures
Marine Risers	Flow Assurance	Advance Engineering	Renewable Energies	Integrity Management

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## 1.0 Introduction

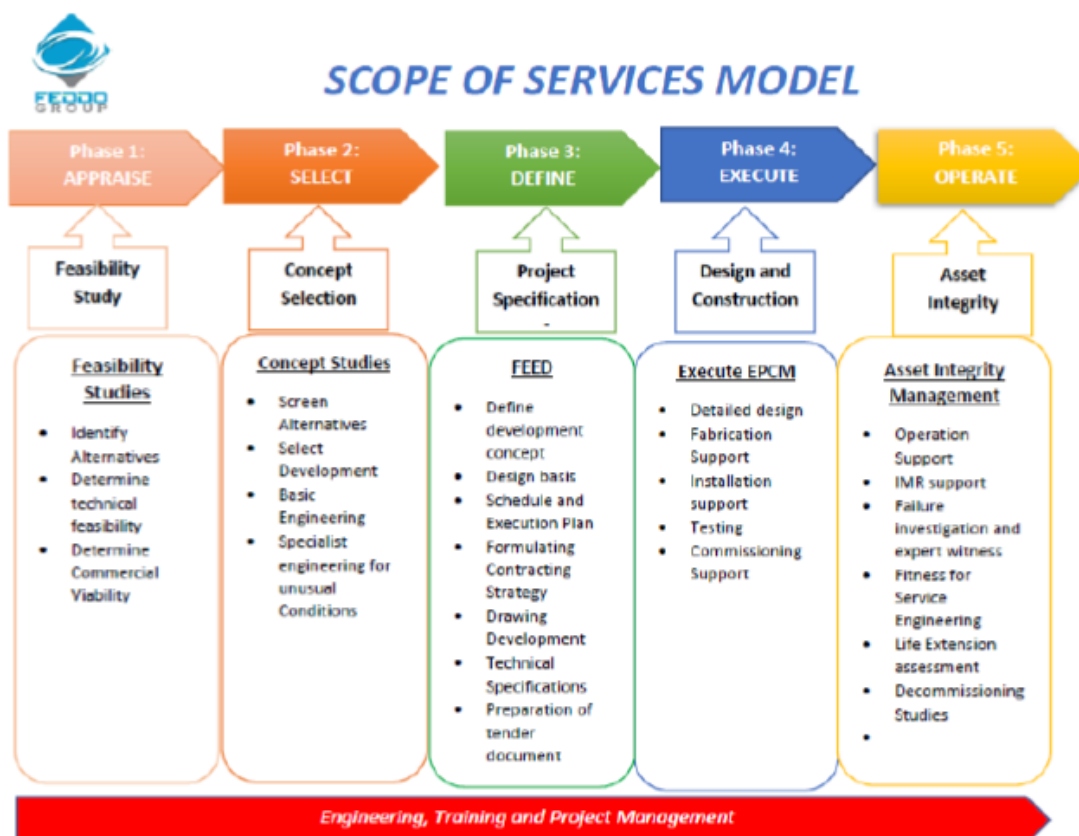
FEDDO Group was established in 2013 as a Global company, registered and headquartered in Australia (Perth)

The main aim is to serve the Energy and Mining sector, providing a range of Consulting Services to the Industry which includes both the Oil & Gas sector, Metal and Minerals and the Renewables sector. FEDDO GROUP specializes in offshore engineering, subsea field developments, subsea and Onshore pipeline systems, integrity management and pigging, life extension, decommissioning, and construction management. We also offer technical training solutions to develop skills and capabilities for the whole life of field covering every aspect of design, operation, integrity management and maintenance.

FEDDO GROUP business model works on a network of regional engineering centres which enable specialised skills, knowledge and expertise to be shared across its global operations.

Our global operational head office is located at Perth, Australia covering Australia and Asia, FEDDO GROUP also has operating offices in Houston, covering the Americas, London, United Kingdom, covering Europe; and Lagos covering Africa, apart from these we have commercial presence (Marketing office) in Kuala Lumpur mainly for South east Asia Region; Abu Dhabi targeting Middle East Region.

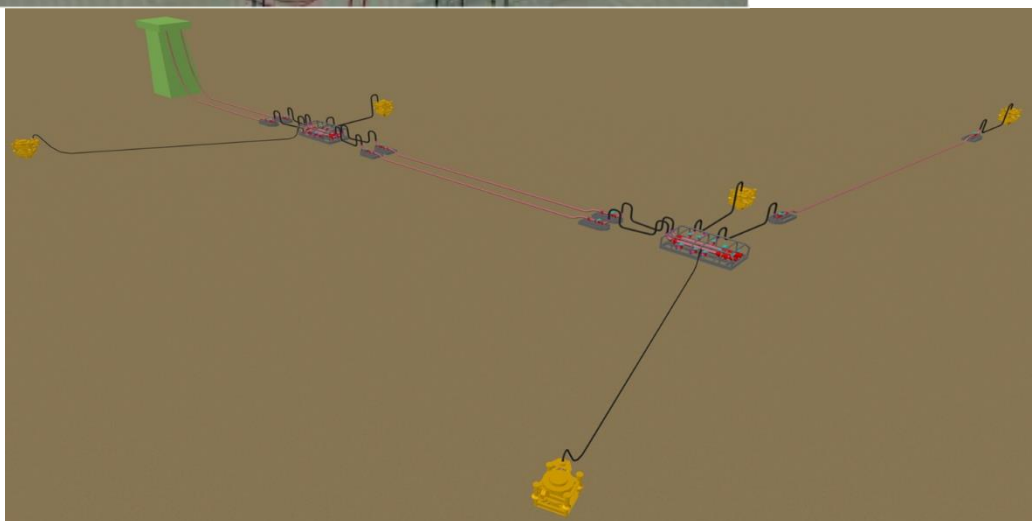
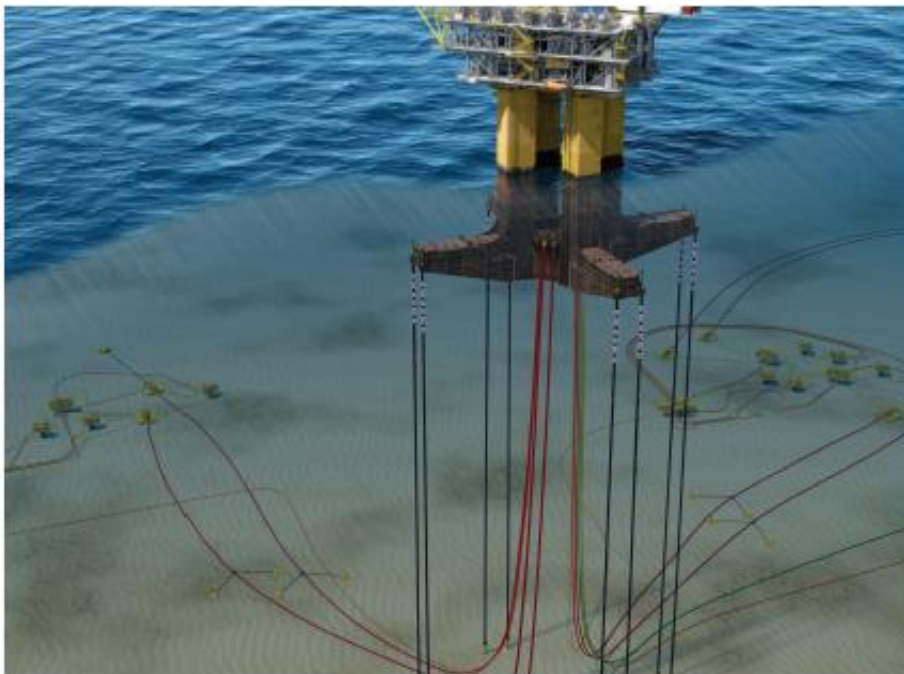
It is our practice to work with client to turn complex situations into positive practical results, by bringing professional insight to support critical business decisions. We work in all phases of project development from appraise, select, define to execute and operate.



FEDDO GROUP provide system engineering comprising the following disciplines:

- Technical Training Solution;
- **Field Development;**
- Subsea Systems;
- Subsea Pipelines;
- Floating Structures;
- Marine Risers;
- Flow Assurance;
- Advance Engineering;
- Renewable Energies; and
- Asset Integrity Management.

This document provides details of our capabilities in Field Development



## 2.0 Field Development Capabilities

FEDDO GROUP's skills can be applied to most of the development phases. For Field Development, the focus is providing clients with high value in the first two phases of the project and development lifecycle: Appraise and Select.

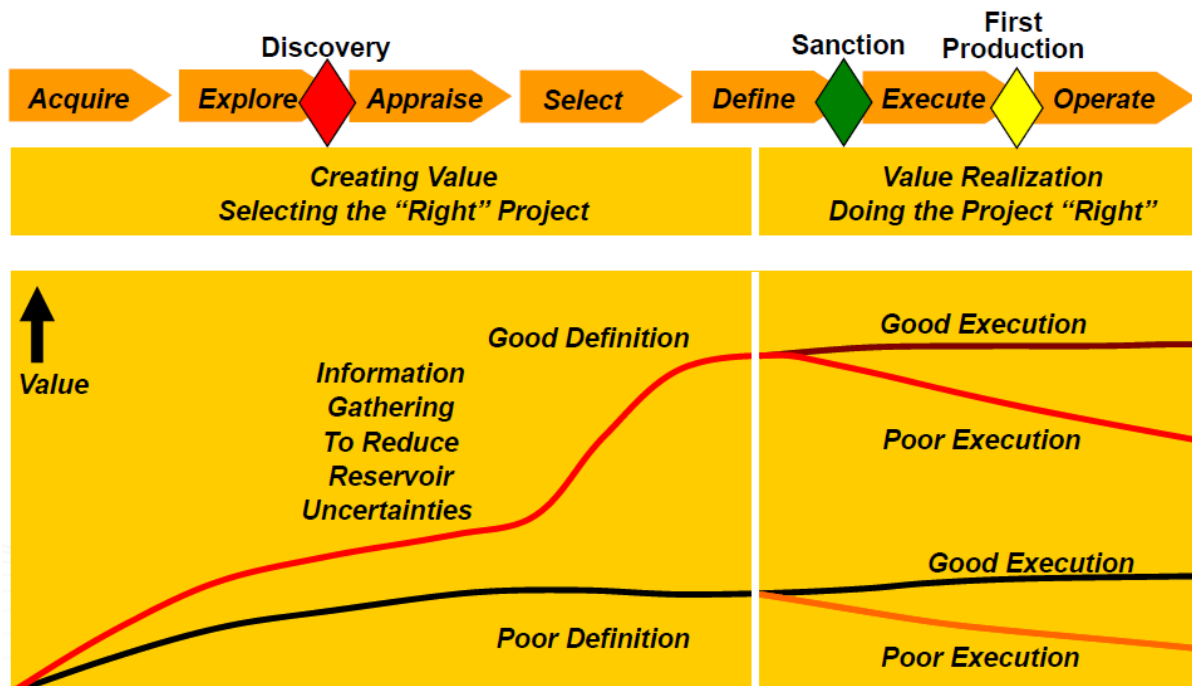
FEDDO GROUP's senior staff, have a broad range of skills and experience generated through all of the phases of a project from the earliest front end and feasibility work, through to concept selection, FEED, detailed design and operation. FEEDO believes that this experience and range of skills is vital to successfully supporting and leading Field Development activities for its clients.

The input and contribution at the front end of project development is focussed on supporting the subsurface workflow, confirming the technical feasibility and providing cost and schedule input to help confirm commercial feasibility.

During the Appraise and Select phases, small highly experienced teams provide clients with a cost-effective way to identify opportunities and assess technical and commercial feasibility.

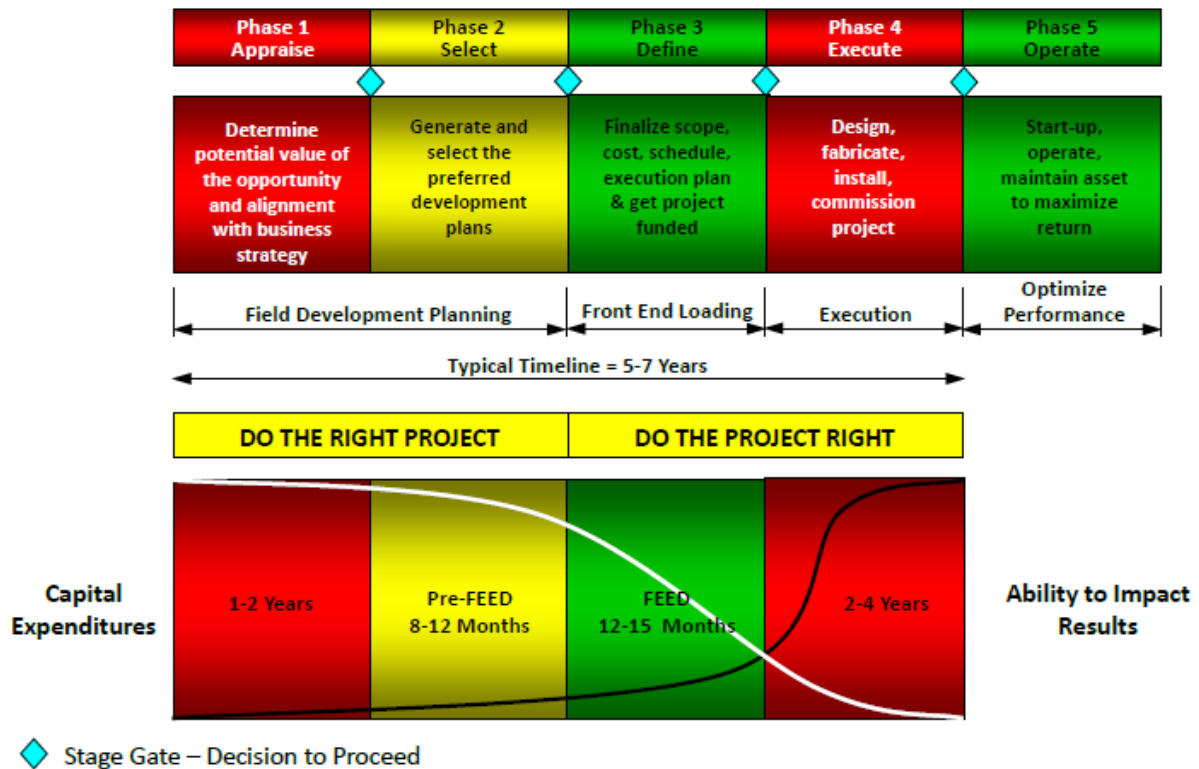
As the development progresses increasing definition is required in line with the increased cost and commitment being sanctioned.

FEDDO GROUP's staff have a wide of experience of onshore and offshore development, both greenfield and brownfield.



### 3.0 Appraise Phase

The identify and assess phase can include a range of activities from exploration and appraisal support, through to scouting studies, feasibility studies and concept identification. FEDDO GROUP's senior staff have extensive experience in supporting and leading all of these activities.



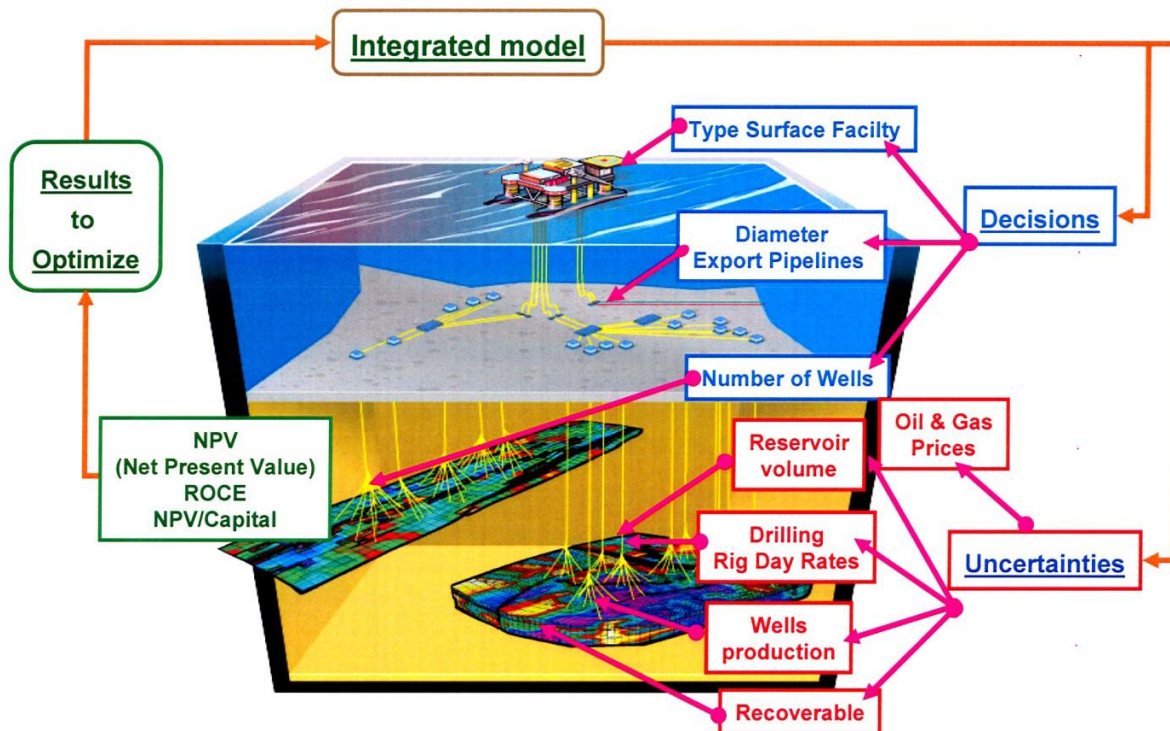
#### 3.1 Exploration & Appraise

There are several drivers for the engagement of Field Development support during the Exploration phase as follows:

- An Operator may be considering bidding for an exploration block, or considering farming in or out of acreage.
- There may be a need to confirm the commerciality of an identified prospect to justify exploration drilling.
- The Operator may need to justify further study and progression to an appraisal phase
- The Operator may require field development work in the development of a strategy for its proven, probable and possible oil and gas assets in a region. In this state, the operator is interested in the value drivers for different product streams to determine which might offer the greatest potential to monetise the reserves

In any case it is common to produce, at a very high level, a cost estimate of a field development plan as input to the economic analysis.





Typical support activities include:

- Assisting in framing workshops;
- Identifying the basis and assumptions upon which the facilities definition will be performed;
- Identifying market opportunities; and
- Preparation of very high-level estimates for costs and schedules.

Given the level of uncertainty, these estimates are normally conducted in a short space of time and at the highest level.

The main deliverables here are concepts level engineering definition as input to cost and schedule estimates along with level sketches of field layout facilities.

The developments considered can be for exploration success for oil only, gas only, or oil and gas. They will typically be considered for a range of subsurface outcomes such as high, medium and low reserves, or for specific reserves ranges.

Consideration may be given to downstream processing options for the production of derivative products which potentially add value to the reserves.

FEEDO GROUP staff have significant experience in supporting these early assessment phases of Field Development.

### 3.2 Concept Identification (Feasibility)

At Concept identification, the objective is normally to identify at least one technically and commercially viable development option rather than attempting to identify a range of options, or identify a preferred option. This minimises the costs and resources before the more detailed phases of study are considered.

Again, the process involves collaboration with the sub-surface, drilling, commercial and other disciplines to match the “knowns” and “unknown” of the potential development to surface facility scheme that will allow commercialisation of the field(s).

Typical supports activities include:

- Study management and coordination;
- Input to, or facilitation of, opportunity framing and other workshops;
- Agreeing input data, or assumptions with the sub-surface and drilling disciplines;
- High level engineering design of subsea and surface facilities;
- High level review of offshore transport and Installation requirements;
- High level flow assurance review;
- Input to, or facilitation of initial Risk and Opportunity review; and
- High level cost and schedule estimates.

The key deliverable is a Concept Identification Report or Feasibility Report that summarises the findings of the studies, and typically benchmarks against analogue projects.

This will include the output from framing workshops, the costs and the high economics.

Concept Strategy Table											
Development Solution	A	B	C	D	F	G	I	K	L	M	N
Ref Case	Subsurface	Well Design	Drilling	Drill Centre Type	Wells	Gathering System	Processing Substructure	Processing	Oil Export	Gas Export	Water Disposal
WHP / FPSO	Field 1	Vert	TAD	Subsea	LWI Vessel	C.S.	FPSO	Oil Stabilisation	Flare	Gas Flare/Injection	Flare
WHP / FIXED	Field 2	Horiz	Modular	Floating Dry Tree	HWU	C.R.A.	Semi	Gas Dehydration	FPSO / FPSO Parcels	Gas Export Existing	Overboard
Subsea to Existing	Analogue A	Multilateral	Jack-up	Fixed Dry Tree	Col	Corrosion Inhibitor	Fixed	Water Treatment	C.S.	C.S.	
Oil and export via existing	Analogue B	Recompletion	Semi		Winkline / Slickline	Flexible Flowlines	Jack-up	Gas Compression	C.R.A.	C.R.A.	

The Feasibility Report may include an initial ranking of the identified concepts, but will in any case aim to at least screen out the concepts that are not worth pursuing at the following Concepts Select Stage.

FEDDO GROUP staff have extensive experience in supporting and leading Concept Identification and Feasibility studies.

## 4.0 Select Phase

The Concept Selection phase is where the range of possible development concepts are considered and narrowed to a point where a single concept is identified and recommended as the preferred way forward.



The objective is to complete sufficient engineering definition to allow comparison of the identified Concepts. FEDDO GROUP staff have extensive experience in supporting and leading Concept Select studies.

Typical support activities include:

- Concept Selection workshop;
- Development of Selection criteria and weightings;
- Concept Engineering design;
- Flow assurance studies, where appropriate;
- HSE evaluations; and
- Preparation of cost and schedule estimates as input to commercial evaluations.

CATEGORY WEIGHTINGS															
ENVIRONMENTAL		HEALTH & SAFETY		TECHNICAL RISK - Subsurface		TECHNICAL RISK - Surface		SCHEDULE RISK		OPERATION RISK		EXECUTION RISK		FLEXIBILITY TO CHANGE	
13%		20%		15%		10%		10%		13%		10%		10%	
SUB-GROUPS															
Category	%	Category	%	Category	%	Category	%	Category	%	Category	%	Category	%	Category	%
Effluent Chemicals Disposal Drill Cuttings Disposal	20	Construction Risk Hook-up/ commiss. Risk Abandonment	15	Drilling Risk	20	Geotechnical Risk	25	Build/Install Dependencies	25	Drilling Interface / SIMOPs	40	Build/Install Complexity	40	Prior to FID	20
Spills & Accidental Discharge	20	Marine Ops	20	Well Reliability and Intervention	10	Weight Growth	25	Schedule Float / Constraints	25	Availability	20	Contracting Strategy	40	FID to RFSU	30
Emmissions Greenhouse Gas	20	Loss of containment item Isolation Risk	30	Changes in bottom hole location Late change in number of wells	10	Flow Assurance	15	Complexity	15	Low Manning	40	Carry over scope hook- up	20	Post RFSU	50
Abandonment	20	Personnel Transfer	20	Sand Management	10	Marine design - moorings, risers, substructure	35	Drilling dependencies	25						
Seabed disturbance & footprint	20	Loss of stability (geohazard, metocean)	10	Water Content Uncertainty	10			Approvals	10						
		Noise and human factors	5	Reservoir Management	30										
				Fluid uncertainty	10										
Subtotal	100	Subtotal	100	Subtotal	100	Subtotal	100	Subtotal	100	Subtotal	100	Subtotal	100	Subtotal	100

The key deliverable is a Concept Selection Report which will summarise:

- Process design and flow assurance;
- Structural and subsea design and installation (where appropriate)
- Comparative Environmental assessments (ENVID or initial impact assessments);
- Comparative Technical safety assessments (HAZOP, HAZID, etc));
- Input to Risk and other strategic study reviews and workshops;
- Field layout sketches;
- Phased CAPX and OPEX estimates;
- Benchmarking against analogue developments and projects; and
- High level economic evaluation.

## 5.0 Define and Execute Phase

FEDDO GROUP' s subsea and floating systems engineers and consultants can provide specialist engineering support to the more detailed engineering definition required during the Front-End Engineering Design (FEED) and Detailed Design phases of a development. More specifically, the strengths are in:



- Subsea Systems;
- Subsea Pipelines;
- Marine Risers;
- Floating Structures;
- Flow Assurance;
- Advance Engineering; and
- Integrity Management

FEDDO GROUP		TOTAL HOURS	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27	Week 28
CTT Number	Title		30-Apr-2016	07-May-2016	14-May-2016	21-May-2016	28-May-2016	04-Jun-2016	11-Jun-2016	18-Jun-2016	25-Jun-2016	02-Jul-2016	09-Jul-2016	16-Jul-2016	23-Jul-2016	30-Jul-2016	06-Aug-2016	13-Aug-2016	20-Aug-2016	27-Aug-2016	03-Sep-2016	10-Sep-2016	17-Sep-2016	24-Sep-2016	01-Oct-2016	08-Oct-2016	15-Oct-2016	22-Oct-2016	29-Oct-2016	
<b>Project Management</b>																														
7000	Coordination & Reporting	2640																												
<b>Electrical</b>																														
2070	Submarine Cable L11 Procurement	36																												
2090	Submarine Cable detailed design	148																												
7500	Field layout	76																												
2700	Electrical Interface and Engineering Support	145																												
<b>Flow Assurance</b>																														
3010	Pipeline Process & Flow Assurance Engineering Management	372																												
3020	Steady State Thermal Hydraulic Analysis	514																												
3200	Transient Analysis of the 1000 Subsea Pipeline System	786																												
<b>Pipelines</b>																														
4010	FEDDO Review & Verification	260																												
4020	Pipeline Route Selection	478																												
4030	Pipeline Mechanical Design	282																												
4040	Pipeline Stability Design	119																												
4050	Pipeline Geom. Analysis	139																												
4060	Pipeline Expansion Analysis	119																												
4070	Tie-in steel design	260																												
4080	Pipeline Global Buckling Analysis	685																												
4090	Riser Design	853																												
4100	Deep Object Protection Design	119																												
4110	Clams Design	238																												
4300	Intervention work and Impact Assessment	210																												
4350	Pipeline Vibration Monitoring Procedures	249																												
4800	Coupling Design	349																												
4700	Installation Specifications	319																												
4800	Pipeline Risk Reviews	182																												
<b>Civil Structures</b>																														
5000	Civil/Structures Engineering Support	211																												
5100	Civil/Structures Design Basis	189																												
5300	Spool Structural Integrity Analysis (Lifting and Installation Activities)	189																												
5350	Steel Structural Integrity Analysis (Lifting and Installation Activities)	260																												
5400	Foundation / Geotechnical	478																												
5500	Structural Detailing	189																												
5800	Jacket Dooding Naval Analysis	172																												
<b>Materials and Corrosion</b>																														
6000	Pipeline Cathodic Protection Design	139																												
6010	Materials Selection	76																												
6020	Materials Specifications, Data sheet and MTO	279																												
		465																												
		11639.5	363	385	350	640	814	947	852	517	613	561	628	628	596	826	547	461	475	524	400	327	236	224	217	175	144	146		

FEDDO GROUP staffs have extensive experience in supporting and leading these types of Field Development evaluations:

- By striving for a fabrication friendly design
- By striving for an installation friendly design
- By Identifying risks and develop mitigation plans
- By developing a manageable contracting strategy
- By developing a realistic cost estimate and schedule

## 6.0 Consultancy Services

### 6.1 Workshops

Field development opportunities commonly employ a range of workshops to focus the development team's energy in structured, time efficient meetings to progress the development and to achieve specific project goals. These can include:

- Opportunity Framing Workshops;
- Value Improvement Workshops;
- Risk and Opportunity Workshops; and
- Concept Screening Workshops.

It is normal for these workshops to be facilitated by non-project team members to ensure independence and allow all team members to fully participate. Experienced workshop facilitators can help deliver focussed results in the short amount of time normally allocated, allowing the study team to be distracted from the study deliverables for as short a time as possible, while still contributing to the key development shaping exercises.

		Likelihood					
		1	2	3	4	5	
		Improbable	Remote	Occasional	Probable	Frequent	
Consequences	5	Catastrophic	5	10	15	20	25
	4	Significant	4	8	12	16	20
	3	Moderate	3	6	9	12	15
	2	Low	2	4	6	8	10
	1	Negligible	1	2	3	4	5

FEDDO GROUP staffs have extensive experience in the facilitation of meetings, reviews and workshops, including:

- Workshop planning, in conjunction with study leader(s);
- Preparation of workshop materials;
- Facilitation of workshop sessions, including scribes if required;
- Production of workshop minutes; and
- Issuing and coordination of workshop summary reports.

### 6.2 Reviews

FEDDO GROUP has senior staffs that have experience in a variety of third reviews such as readiness reviews, design reviews and safety studies.

Typical reviews have included:

- Readiness reviews (pre-start up);
- 3<sup>rd</sup> party Reviews of design,
- Due diligence reviews; and
- HAZID, ENVID, HAZOP

### 6.3 Software Tools

The primary Field Development tools used by FEDDO GROUP are:

- HYSYS;
- PIPESIM;
- OLGA (with PVTSIM);
- In-house software; and
- In house database of cost, designs, schedules.

FEDDOGROUP has extensive experience of projects including costs and schedules. This data is contained in an internal FEDDO GROUP database that is routinely used as input to various field development studies and reviews.

## 7.0 Project Management Services

In addition to discipline engineering roles, FEDDOGROUP can and has provided Project management Services in the form of provision of owners engineering teams, supervising the EPCIC contractors during Define and Execute.

For Further information:

Contact: [info@feddogroup.com](mailto:info@feddogroup.com)