

## Subsea Long Tiebacks

(Output from ITF Theme Day, Aberdeen)

### Collaborative Approach to Technology Investment

**The Industry Technology Facilitator (ITF)** is a not for profit organisation owned by, and with access to funds from major oil and gas operating and service companies that comprise its membership. ITF has an impressive track record in delivering finance to help develop new initiatives for oil and gas technologies from early stage joint industry projects (JIPs) through to field trials and commercialisation. Since 1999, ITF has supported over **135** projects worth in excess of **£39 million** in funding. ITF's key objectives are to identify technology needs, foster innovation and facilitate the development and implementation of new technologies.

A fundamental element of ITF's role as an internationally recognised champion for facilitating research, development and deployment of technology innovation within the upstream oil and gas industry is to engage with key industry sources. ITF uses a proven process, working in collaborative participation with both its Members and industry to identify technology needs and potential solutions.

**The ITF process**, illustrated below as a step-by-step course of actions, endeavours to bridge the gap between the industry's large global players and development community with the ultimate aim of implementing new technology solutions:

- STEP 1** - Understand and Identify Technology Needs
- STEP 2** - Engage the Development Community / Invite Proposals
- STEP 3** - Evaluate Proposal Submissions
- STEP 4** - Secure Funding
- STEP 5** - Assist the Launch of JIPs
- STEP 6** - Facilitate the Implementation of Technologies

ITF has contractual confidentiality arrangements with all its Members and will enter into a parallel agreement with all developers submitting proposal applications. Proposals will be submitted to our Members only for the purpose for which they are provided, i.e. assessment for funding support and implementation.

Proposals submitted under this Theme will be reviewed for financial sponsorship by **all ITF Members** therefore this is an excellent opportunity to gain access to a global audience in seeking support for your technology. The focus of all ITF themes is to identify technologies which bring clear benefits to sponsors but which require assistance in **research, development, and / or field trial**.

For details of ITF's full Portfolio of Members, please visit our Website - [www.oil-itf.com](http://www.oil-itf.com)

## Background to the Theme

This Call for Proposals is the collective output of an ITF 'Subsea Long Tiebacks' Theme Day held in Aberdeen on 17<sup>th</sup> March 2009.

Subsea long tiebacks are set to become a major factor in the development of new oil and gas reserves in the 21st century. Subsea tiebacks provide a number of important benefits in the development of oil and gas fields. Because much of the infrastructure is already in place, projects can be fast tracked and brought into production much more quickly.

Many companies are pushing forward the technology of subsea long tiebacks to produce more oil and gas at lower cost, over longer distances and in deeper waters. Nevertheless, issues still exist in areas such as subsea infrastructure, cost, deployment, power distribution, flow assurance, processing, and HPHT. All of which allow us to reach the ultimate goal: "subsea-to-beach".

The Theme Day included an intensive, facilitated workshop which brought together experts from ITF membership, operators, service companies, small and medium-sized enterprises, and research and academia. This wide variety of attendees discussed the challenges faced within the area of 'Subsea Long Tiebacks', the output of these discussions has formed the basis of this Call for Proposals.

## Theme Timeline

Each ITF Theme follows a nine month timeline from Theme Day to Theme Completion. The following list of tasks describes the key milestones and their associated date:

Theme Start / Theme Day	17 Mar 2009
Call for Proposals Issued	4 May 2009
<b><i>Deadline for Receipt of Proposals</i></b>	<b><i>30 Jun 2009</i></b>
Publish to Members for Review	Jul 2009
Member Review and Voting	Aug 2009
Technical Clarification Meeting	Sep 2009
Members finalise commitment to sponsor	Dec 2009

## Open Invitation to Global Technology Developers

This document aims to stimulate proposals from global development expertise which meet the specific requirements for deployment within the area of '**Subsea Long Tiebacks**'. ITF and its Members will jointly assess all submitted proposals and our Members will potentially fund those proposals of greatest interest.

ITF and its Members will not prescribe specific technology solutions, but instead use the output gathered from the Theme Day to stimulate innovative proposals that offer potential solutions to identified needs. Key technology drivers, as identified by ITF Members, are the desire to produce fields in a more cost effective and efficient manner.

Some of the short term challenges in subsea long tie-backs involve subsea processing and transportation and are already being handled by our members in specific field development projects. Hence, some of these challenges will have limited priority for funding; however, there are some key technology challenges where collaborative funding will be of benefit to fundamental research, development, and piloting of those technologies further along the technology readiness scale.

This is an open invitation to any organisation seeking sponsorship for innovative technologies in the oil and gas industry to submit proposals for research, development, and / or field trial in the following areas, associated with the identified needs of the Subsea Long Tiebacks theme.

Multiphase Fluid Flow and Flow Assurance (especially hydrate management)  
Subsea Processing  
Subsea Electrical Power Supply and Distribution  
Control, Communication and Instrumentation  
Lower Cost Pipelines  
Information Management

Moreover, there is a need for all technologies to contribute to increase recovery rates from subsea completed wells to reach similar levels as platform completed wells. More cost-efficient solutions will be required to enable smaller and deeper discoveries to be developed.

The 'long distance' in the context of this Call is a difficult one to address due to the complexity of subsea developments dictated by individual field requirements. Snøhvit (145km) and Tyrihans (50km) fields are good examples of what can be done now for gas/condensate and oil respectively. Nevertheless, the stepwise goal is to enable >500km for gas/condensate and >200km for oil-dominated multiphase transport.

The list of detailed technology challenges are identified within each area that are of explicit interest to ITF Members in the 'Specific Technology Requirements' below. This information highlights key elements required but allows for innovation and flexibility in interpreting the most appropriate technical solutions.

The method for submitting a proposal is described later in this document but you can also learn how to submit a proposal by going to our website [www.oil-itf.com](http://www.oil-itf.com)

## Specific Technology Requirements

(Any submitted proposal **must** address one or more of the following identified requirements)

### FLOW ASSURANCE CHALLENGES

#### Background:

There are strong incentives to develop more distant oil fields with direct subsea transport of the well stream. Flow assurance challenges relate mainly to unstable flow and fluid control (wax and hydrates). Today's approach to well stream transport is to avoid low temperatures by pipeline insulation combined with direct electrical heating and/or hydrate inhibition for shutdowns. For long tie-backs heating and insulation becomes very expensive and other methods allowing 'cold flow' need to be considered.

#### Requirements:

- Gas condensate or oil dominated multiphase flow, corrosion control, scale build up, wax and hydrate plugging risk are the main flow assurance challenges to be resolved.
- Improved efficiency through subsea removal of water and sand.
- Better understanding and confidence in 'cold flow' technologies promoting hydrate slurry transportation without agglomeration
- Improved production/design models
  - Operating within the hydrate stability zone
  - Pipeline management modelling
- Distributed monitoring systems
  - Subsea monitoring of produced water
  - Temperature tolerance management
  - Pipeline/In-line separator
- Better flow assurance remediation techniques (e.g. hydrate plug removal) are needed to cut the cost of backup solutions, including improved pigging technologies.
- Capability improvements for direct electrical heating; significantly beyond current practical limits.
- Increased chemical efficiencies, compatibility, and their control and use
  - Low dosage hydrate inhibitors
  - Kinetic hydrate inhibitors (KHI)
  - Anti-Agglomerants (AA)
  - Natural inhibitors
  - Affect on existing facilities, e.g. LNG facilities.
  - MEG regeneration in gas systems

## SUBSEA PROCESSING

### Background:

Implementation of current subsea processing technology is happening but is limited and an increase in capability and functionality is needed. This includes equipment for multiphase transport over long distances such as gas compression, high capacity multiphase pumps, efficient three-phase separation, and subsea injection of gas and water.

### Requirements:

- Lightweight and compact separation equipment
  - Solutions should look beyond traditional gravity separation vessels used on topside installations
  - Solutions for handling removed sand (other than reinjection with water)
  - Oil in water measurement for subsea separators (topside instruments cannot be easily adapted)
- Cost effective single well processing solutions are needed as well as multi-well ones
- Subsea (raw) seawater injection systems
  - Assessment of reservoir stability as a result of seawater injection
- Increase in the performance and reliability of subsea multiphase pumping
  - Multiphase boosting target: 150-250 bar
- Small and large scale subsea gas compression (dry and wet)
  - Possible capacity, 8 - 80MW (some looking beyond 150MW?)
  - Robust and reliable improvements relate to compression efficiency and size of electric motors

## SUBSEA ELECTRICAL POWER

### Background:

Current developments of subsea electrical equipment has been mainly control systems, but future field developments will demand steadily higher power at longer distance from existing infrastructure. This will lead to a demand for reliable subsea high voltage equipment and frequency converters.

### Requirements:

- Challenges in the power supply area are related to:
  - High voltage design for components (>6.6kV)
    - Transformers, switchgear, VSDs, wet-mateable connectors, etc
  - Pressurized frequency converters and other (wet?) electronic chambers
  - Influence of humidity, temperature and pressure on insulation material

- Test/qualification methods for electrical equipment to be used subsea
- Methods for extended range AC transmission
- Systems for DC transmission (subsea inverters) – (up to 250MW?)
- Local power generation (Capacity: 1 – 12MW)
  - Using process fluid, renewable (wind, wave, and geothermal) for equipment that requires intermittent use
  - Relatively 'safe' nuclear power sources, e.g. use of thorium
  - Long life batteries
  - Fuel cells
  - Non-umbilical solutions – through the pipeline?
- High efficiency transmission – repeater stations, materials, low power subsea electronics

## CONTROLS, COMMUNICATION AND INSTRUMENTATION

### Background:

To efficiently operate the process control systems and utilize the information gathered, high capacity communication systems are required. Both infield distribution systems and transfer systems needs to be developed. Current high capacity systems are available between platforms and shore, but not from subsea installations to platform/shore.

### Requirements:

- Improved reliability and robustness of instrumentation over long distance
  - Downhole monitoring- flow, temperature, pressure
  - Leak detection
  - Low cost, high accuracy, retrofit metering systems, e.g. for wet gas, subsea multiphase flow; maybe using wireless technology
- Long distance, high capacity communication
  - Possible use of pipeline for communication link
  - Improvements to the lag in real time data
  - Increased bandwidth
  - Adding new links/branches to existing optic fibres
- Autonomous systems
  - Optimisation of fluid parameters
  - Remote diagnostics and shut-down capability
- Early warning production monitoring
- Effects of changes to Electrical/Hydraulic control in particular regard to the well head assembly critical interface requirements, e.g. SCSSVs

## LOWER COST PIPELINES

### Background:

The potential of innovative technologies offer significant cost savings when compared to existing pipeline solutions known to the industry. The use of composite materials and coatings are only some of the recent engineering improvements that meet the ever increasing challenges within the industry.

### Requirements

- Optimised pipelines and risers for cost efficiency
  - Materials and construction
  - Possible use of composites materials as an alternative
- Pipeline insulation
- Multiple service pipeline concepts
- Improvements in the welding of corrosion resistant alloys (CRA) and automated ultrasonic testing (AUT)
- Use of internal coatings, e.g. nano-technologies
- Corrosion coating for high temperature applications
- HIPPS (or equivalent) to allow down-rating of export lines

*NB. Inspection techniques (internal and external) will be covered in our call later in the year on the theme, 'Corrosion and Erosion: Detection and Mitigation'. Our Theme Day for this is scheduled to take place on 21 May 2009 in Aberdeen, see our website for further information [www.oil-itf.com](http://www.oil-itf.com).*

## INFORMATION MANAGEMENT

### Background:

Subsea long tie-back incorporate many aspects of subsea processing and transport as characterized in the above challenges and much work is on-going that is competitive between not only suppliers but also between operators. Nevertheless, there are fundamental elements of knowledge that would be of benefit to all that could be collaboratively developed that lead to a clearer understanding of generic needs.

### Requirements:

- Better understanding of multiphase pipeline flow and its assurance with particular attention to defining the complexity of the fluids
- Better understanding and models for multiphase fluid characterization and mechanics
- Better ability to model and validate data in an attempt to improve reliability

## Process for Submitting a Proposal

### 1. Register Interest with ITF

Register your interest as early as possible by sending an email to Ryan McPherson at [r.mcpherson@oil-itf.com](mailto:r.mcpherson@oil-itf.com)

### 2. Visit the ITF Website - [www.oil-itf.com](http://www.oil-itf.com)

On the ITF Home page, click on the "How to Submit a Proposal" button or follow [this link](#) to access all the information required to submit a proposal.

### 3. Read the 'Project Application Guidance' Document

This document is available to view or download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website. Reading this document prior to submitting a proposal is essential. If you require further clarification or are unsure if your proposal is suitable for submission, please call ITF (ITF Contact Information appears later).

### 4. Download and Complete the 'Project Application Form'

This form is available to download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website.

### 5. Download and Complete the 'Project Presentation Template'

This template is available to download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website.

### 6. Email the Completed 'Project Application Form' and 'Project Presentation Template' to ITF

Email the Completed 'Project Application Form' in Microsoft Word format (not PDF) and the 'Project Presentation Template' in Microsoft PowerPoint format (not PDF) to Ryan McPherson at [r.mcpherson@oil-itf.com](mailto:r.mcpherson@oil-itf.com) by **no later than 30<sup>th</sup> June 2009**. Proposals received after this date may not be processed.

## Qualifying Technologies

In order to qualify for potential sponsorship, technologies submitted in response to this Call for Proposals must:

- be applicable to at least one of the identified requirements
- be novel or innovative
- demonstrate a clear business case for support
- have a clear and demonstrable path to commercialisation and implementation
- be capable of being developed by the proposer(s)

**Note:** Proposals submitted to any other ITF Call in the past nine months or any previously unsuccessful applications should not be resubmitted without first consulting ITF (contact information provided later in this document).

## Qualifying Organisations

Proposals are invited from any organisation including SME's, academia, research institutions, large organisations, consortiums or alliances. Proposals may be submitted by a national or international organisation, and equal opportunities will be extended to all proposers. Please keep in mind however that should your proposal be taken forward, you will be required to participate in meetings and make presentations to interested parties in the UK and in the English language (teleconference and video conference are acceptable).

## ITF Contact Information

If you would like to discuss any matters related to this call or any other issue related to ITF, please contact any of the following people:

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For more information on ITF please visit the ITF Website - [www.oil-itf.com](http://www.oil-itf.com)