ITF Call for Proposals

Focus: Produced Fluids Management

Improved Solutions for Managing Produced Fluids in the Oil and Gas Industry

Aims

This is an open invitation to any organisation from any industry sector seeking funding for innovative technologies in the oil and gas industry to submit high quality proposals for research, development and / or field trial of potential solutions that will help meet the current challenges of produced fluids management.

Produced Fluid areas of interest:

- **Produced Water Management**; produced water polishing, understanding the impact of produced water reinjection on the reservoir, corrosion management of produced/injected fluids.
- **Sand Management**; prediction, qualification and quantification.
- **Process Control and Design**; integrated modelling and control, compact portable water and solids handling kit
- **Subsea Separation**; chemical optimisation and management

Justification

ITF members, major operating and service companies in the oil and gas sector, met recently at an international ITF Technology Challenge Workshop (TCW) and explicitly identified the current shared challenges they are facing across the industry in the area of high pressure, high temperature oil and gas production.

Who Should Respond

The invitation is open, to all relevant industry sectors and all credible entities from small and medium sized enterprises, to academic and research institutions, to large industry players alike.

Benefits of Participation

- Funding: Up to 100% funding for any stage of the research, development and demonstration cycle.
- IP Protection: A proven confidential, collaborative and standard contractual process
- Exposure and validated applications for your scientific and technological expertise
- Access to the key global players in the oil and gas sector

How to Participate

Your contact points and outline method for submitting a proposal are provided in this document but you can immediately learn how to submit a proposal by going to our website http://www.oil-itf.com/index/submit-a-proposal

Alternatively you can ring us and talk to one of our analysts about your idea, +44 (0)1224 222410.

Key Words

Sand management; sand analysis; sand monitoring; sand polishing; sand removal; sand prediction; water polishing; produced water reinjection; frac water treatment; multi-phase measurement; solids handling; online oil in water analysis; hydrocyclone monitoring; downhole chemical monitoring; energy efficiency; smart control systems; foam detection; subsea separation; non-weir separation technology; downhole separation; salt management; sand screen improvement; norm measurement; chemical management; corrosion management.

(NB. The above list is not necessarily exhaustive).

Readers who are not familiar with the industry may find using some of the above terminology on a *Wikipedia* search on the internet would lead to some useful initial descriptions of the industry and associated techniques. It will also provide other links that would be equally useful.

Produced Fluids Management Challenges

The prime areas of concern have been identified by ITF members as follows:

Produced Water Management

To realise maximum recovery, produced water is often injected back into the reservoirs to help force hydrocarbons to the surface in a technique known as produced water reinjection (PWRI). The re-injected water is eventually produced with the hydrocarbons along with the formation water meaning that the produced water content of the oil increases. Excessive water production can kill wells prematurely; therefore it would be helpful to investigate ways of improving the prediction and understanding of produced water characteristics and its impact on the reservoir. For example, fracture modelling is critical to predicting PWRI behaviour. A key objective is to maintain injectivity while increasing production and reducing costs.

The Challenges

- Alternative technologies for produced water polishing which are compliant with relevant legislation and possible future scenarios, for example OSPAR[1]. The main challenges are to monitor (perhaps online) and lower oil-in-water content and harmful dissolved hydrocarbons, to ultimately achieve zero discharge, or 'no harm' to the environment.

- Systems to clean water thus satisfying reinjection in terms of corrosion management and environmental requirements. For example evaporators are used by the water industry.

- Innovative design of produced water re-injection PWRI facilities to ensure that no additional contaminants get into the produced water stream on its way to the sand face. New methods for predicting reliable values for potential loss of permeability from residual solids and oil contents.

- Determine the real magnitude of thermal effects in PWRI by developing methods of cooling produced water as a means of improving the ability to fracture.

- Formation fracture simulation with PWRI - better geotechnical models. Better understanding of fracturing within PWRI

- Techniques to prevent excessive water production by using more intelligent field management to look further into formation.

- Hardware for providing chemical delivery to exactly the right place in the reservoir. Inherently reliable chemical injection systems, for example unmanned platform subsea injection requiring subsea metering.

- Address the issue of chemical compatibility and optimisation. Assess the impact of chemical incompatibility on chemical performance, process performance, the environment and the reservoir through PWRI.

[1] OSPAR - The Convention for the Protection of the Marine Environment of the North-East Atlantic

- Alternative performance monitoring tools to examine corrosion, scale, asphaltene and wax.
- Downhole chemical monitoring and real-time measurement of fluid chemistry permitting feedback to system model.
- Technologies to specifically address coal bed methane produced water issues such as handling, treatment and disposal.
- Corrosion management of produced and injected fluids.
- Flowback frac water handling. Disposal of contaminated produced water and handling and treatment of frac water in shale gas fields for re-use.
- New and innovative ways to achieve downhole chemical and mechanical water shut-off.
- When produced water is mixed with other water, there is the increased risk of scale, bacteria and compatibility issues, therefore an improved understanding of scaling mechanisms, inhibitor performance and design and the impact on the reservoir e.g. reservoir souring is required.
- Define the specification of produced water that will not negatively impact injectivity or the reservoir.

Sand Management

Sand production, along with its management and transportation prior to disposal are major issues, with the prediction and modelling of sand production being a key factor. In order to decide on whether to prevent or manage sand production, it is essential to know the maximum sand-free rate and the maximum acceptable sand rate as zero sand production may not be possible. If facilities can be provided to give assured particulate removal from the fluid stream then active sand controls such as screens and gravel packs may not be required. Passive sand control methods such as selective and orientated perforating, and controlled drawdown may instead be used.

A key question is whether it is better to manage sand downhole, for example seabed separation of sand pre-treat and dump to sea or manage it at the surface, effectively removing it from separators.

The Challenges

- More effective technologies for predicting and detecting sand both downhole and topsides.
- Improved quantification measurement and batch sampling of produced sand volume, for example utilising reliable and accurate acoustic sensors, evaluating correct placement and calibration - and making use of computational fluid dynamics.
- Technologies such as phenomenonological models and computational mechanics to gain a better understanding of rock mechanics, formation characterisation and sand dislodgement. New software would provide advanced warning combined with monitoring to inform the production strategy and profile.

- Alternative remedial chemical or mechanical management of unpredicted sand volumes during operations due to equipment failure downhole and topsides. For example exploring the use of sand consolidation, gravel packs and retrofit screens to minimise sand production and optimise reservoir development.

- Techniques for measuring oil content in sand, sand polishing and washing, handling fines and cleaning with minimum equipment prior to disposal.

- Improved accuracy of various log based sand strength evaluations, the best practice for selection of strength correlations.

- Improved performance monitoring and reliability of sand screens with respect to temperature, pressure and flow, and remedial strategies for sand screen failure.

- New techniques for online sand analysis, acoustic monitoring and measurement of quality and content.

- Systems for achieving remotely operated sand management and removal upstream of separators.

Process Control and Design

The real challenge in this area is to achieve a reduced process facility footprint while maintaining capacity flexibility and production levels. Process debottlenecking and improved energy efficient designs are two ways this can be accomplished. Other such smart design innovations are essential to help minimise the size and weight of production equipment and to address space and weight constraints. Design should consider the greenfield to brownfield lifecycle and this may inevitably involve the retrofit of existing equipment.

Achieving compact, portable water and solids handling will lead to a decrease in the number of wells that are shut in due to back pressure and high water and sand production. Again, debottleneck existing wells will also contribute to increased production.

The Challenges

- Designs on more conventional coalescing technologies and methods of filtration. Ozone oxidation has promise, however the current systems are too bulky and over complicated.

- Design of smarter, more robust equipment to carry out bulk removal of water.

- New and improved multi-phase measurement kit for the full lifecycle.

- Ways to establish compact equipment integration and thus reducing vessel loading requirements.

- Cost effective enhanced monitoring of hydrocyclone condition on older assets. Perhaps using technical knowledge transferred from other industries.

- Characterisation, separation and handling of produced solids.

- Different designs of integrated modelling and faster control systems to optimise well production and debottleneck plant. Consideration for fast response to process upsets. Condition based monitoring to aid rapid on-platform decision making, to control and predict failures and to schedule preventative maintenance.

Subsea Separation

Treating production at source at the seabed can help maximise recovery, increase pressure to above 200bar and hydrocarbon output at fields with low reservoir pressures. The elimination of surface separation gear replaced by subsea separation equipment also saves platform space and lowers weight-support requirements thus reducing constraints on topside facilities. A compact footprint is essential to, for example, simplify ROV change-out of equipment.

The Challenges

- Complex and efficient methods of separating waxy sandy water, some gas and CO2 crude in a remote location.
- Effective removal of sand from separators.
- Foam and emulsion detection in separators.
- Cyclonic devices for separation of solids, then oil/water, then gas.
- Technologies to optimise the separation sequence subsea. For example, hyperbaric testing facilities could be used for separation and modelling.
- Improved management of co-mingled produced fluids, including waters with scaling potentials destined for PWRI and mixed with cold seawater into multiple reservoirs.
- Better understanding of chemical and biological interactions and their impact. This includes chemical optimisation, monitoring and management for separation issues and the application of membrane technology in water clean-up to reduce sulphate content and therefore the chemical dosing requirement. The aim is to minimise chemical use as far as possible by using the lowest levels possible without any environmental impact.
- Alternative designs for internal variable control in separators allowing reactive operation and greater flexibility over longer periods of production.

'Other'

Several other challenges that have been identified are listed below:

- Alternative technologies for topsides non-weir oil and water separation.
- Methods to prevent solids deposition and formation during MEG[2] reclamation.
- Improved salt management, specifically in shale gas fields, through alternative well design and innovative prediction and prevention techniques.
- Ways to achieve viscosity reduction on difficult crude oils.

[2] MEG - Mono ethylene glycol

ITF's Role & Approach

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 **150** projects worth **£50 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 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

Theme Timeline

The ITF Technology Challenge follows a staged timeline from the initial workshop through to launch of successful projects. The following list of tasks describes the key milestones and their associated date:

- Programme Start: Technology Challenge Workshop — Aug 2010
- Call for Proposals Issued — Oct 2010
- ***Deadline for Receipt of Proposals*** — ***10 Dec 2010***
- Publish to Members for Review — Jan 2011
- Member Review and Voting — Feb 2011
- Technical Clarification Meeting — Mar 2011
- Members finalise commitment to sponsor — Apr 2011

Process for Submitting a Proposal

1. **Register Interest with ITF**
   Register your interest as early as possible by sending an email to Keith Mackie at k.mackie@oil-itf.com.

2. **Visit the ITF Website -** 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 (Contact Information below).

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 Keith Mackie at k.mackie@oil-itf.com by **no later than 10 December 2010**.

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

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:

Technology challenge manager and primary contact point for this Call:

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For more information on ITF please visit the ITF Website - www.oil-itf.com