Subsea 7 has been successfully installing electrical heating systems since 2007 including the world’s deepest open loop Direct Electrical Heating (DEH) system. Subsea 7, with its extensive proven track record in the design, fabrication and installation of Pipe-in-Pipe solutions, has developed and is now qualifying one of the most efficient heating technologies: the Electrically Heat Traced Flowline (EHTF).

**Key benefits:**
- Reduced CAPEX and OPEX
- Improved access to reserves, allowing for long tie-back with no looping requirement
- Improved availability of production systems due to enhanced thermal performance
Electrical heating technologies overview

Electrical heating technologies are enabling solutions for development of subsea fields. By maintaining the appropriate product temperature within the pipeline, they avoid hydrates and wax formation. CAPEX is reduced by eliminating the requirements for looped flowlines (or a service line) for dead oil circulation. OPEX is reduced through lowering the amount of chemicals injected in the flowlines and time required to restart operations after shutdown as well as topsides chemical storage requirements.

The graph below provides an overview on the performance of pipeline technologies, highlighting the areas of applicability for electrical heating systems.

DEH Overview

Design

The principle of the Direct Electrical Heating (DEH) system is that an electrical loop is generated from a Current generator located on the topsides directly connected to both ends of the pipeline.

EHTF Overview

Design

The Electrically Heat Traced Flowline (EHTF) is a combination of a high performance thermal insulation (Pipe-in-Pipe) with a resistive electrical heating system provided by wires laid between the insulation and the flowline.

Main Features of EHTF System are:

- To allow for restart after long shutdowns with no specific preservation measures
- To maintain flow-line temperature above WAT or HAT (Wax & Hydrate Appearance Temperatures)
- Low required electrical power to heat (typically 20 W/m)
- 3-phase wiring triplets in a star arrangement
- High specification insulated heating wires

Benefits

EHTF PIP enables development of fields requiring very high thermal performance caused by:

- Long flowline length for long tie backs from central production unit

Main Features of EHTF System are:

- Reduced footprint on topsides: solution of choice for brownfield developments and tie-backs to existing infrastructure due to low power and reduced chemical storage
- Difficult fluid characteristics

Additionally, EHTF technology allows for some redundancy with additional triplets in the cross section meaning that reliability and performance are guaranteed with a simplified and customisable topside operational philosophy.

EHTF Performance

High performance PIP associated to active heating offers:

- Up to 60km long tie-backs
- Up to 3000m water depth
- 6-inch to 12-inch typical inner diameter range (main bore) Down to U-Value < 0.5 W/(m²·K) with low pressure annulus
- Low power requirement, minimum impact on topside
- Low voltage required, allowing for standard field proven electrical equipment

The following graph illustrates the low power required for EHTF system even in deep water and for long tie backs.

Subsea 7 Pipe-in-Pipe Experience

Subsea 7 possesses an extensive proven track record, built up over 30 years, in performing the full design, procurement, fabrication and installation of standard Pipe-in-Pipe systems (PIP).

Subsea 7 has successfully completed more than 50 PIP systems by S-lay, U-lay, Reel-lay and towed bundles including:

- Size range from 5-inch/8-inch to 16-inch/20-inch PIP
- Water depths from 40 to 1,400m
- Lengths up to 40km

Benefits

EHTF PIP enables development of fields requiring very high thermal performance caused by:

- Long flowline length for long tie backs from central production unit

As a comparison, for a given tie-back, presenting the same flow assurance constraints, the power required by DEH would be 10 times higher than the one required with EHTF solution.
Subsea 7 / ITP EHTF references

2011 – EHTF Qualified by IOCs DNV Certificate of Fitness For Service: for the Subsea 7 / ITP reeled EHTF (6”x10”) PIP system

2012 – First ITP Trace Heated PIP: Kinosis Project for 22km onshore electrically heat traced pipeline at 150°C (design temperature)

EHTF qualification programme

A comprehensive development programme has been conducted in accordance with DNV RP-A203 to demonstrate the viability of this technology as “Fit for Service”.

- **Electrical wires** (incl. In-line connections)
- **Electrical connectors/penetrators**
- **Temperature monitoring system**
- **PIP cross-section arrangement**

- **Power supply & Control system** (topside and subsea)
- **Umbilicals & flying leads**
- **Subsea structures** (FLET, ILT and PLEM)

Main qualification plan programmes outline:

- Electrical wires qualification tests in representative (PIP annulus) environmental conditions
- Electrical connectors/penetrators qualification tests according to EHTF specification based on industry standards
- Cross section validation through full scale tests and extensive engineering studies

Products qualified for design life up to 30 years.

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[For website links and further information](www.subsea7.com)