Flow assurance is increasingly challenging as the oil and gas industry is moving towards deeper water and longer transport distances. Formation of hydrate and ice plugs in the pipelines will have major cost impact and must be avoided as removal of plugs is a challenging and time consuming operation. At deeper water plug removal by depressurization may be impossible. As a mitigation measure active heating may be applied.

Direct Electrical Heating (DEH) is now in use on several pipelines on the Norwegian Continental Shelf. In the DEH system the current is conducted to the far end of the pipe through a DEH cable. The temperature increases as current returns in the pipe. The increase of the temperature results in melting of the ice plug.

Studies have shown that it is important to keep the separation distance from the cable to the pipeline small in order to limit the required supply current. Therefore the DEH cable is normally installed with the pipeline in a so-called “piggy-back” configuration. For Ormen Lange, however, DEH is designed for remediation purposes where DEH cable and equipment will be installed on demand. Installation evaluation confirms that a maximum average gap of 0.5 meters between cable and pipeline is feasible for Ormen Lange.

This paper presents results from laboratory experiments where an ice plug is formed in a 4.5 m long 30” pipe joint. The ice plug was melted using DEH. Both the separation distance and current were varied.

The experiments showed that 3% of the ice plug got melted at an ambient temperature of -2°C and a pipe current of 1300A for 48 hours. 6% of the ice plug was melted when the applied current was increased to 1500A for 48 hours.