The Standard

**Skill and planning keep the gas flowing**

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The recent disaster of the Nord Stream undersea gas pipes has strangled natural gas supply to many parts of western Europe.

Laying undersea gas pipelines requires extremely specialized machinery and meticulous planning and involves a great deal of engineering expertise.

Gas pipe laying on the seabed is much more complicated than on land. The seabed is generally rough terrain, often with peaks and valleys.

Finding a route smooth and straight enough for pipeline laying is challenging. Careful planning of the route is necessary to minimize dredging and cavity filling, which invariably adds to the expense in time and costs.

A typical underwater gas pipe system has a steel pipe of about 1,200mm diameter. The pipeline must withstand the high pressure of the gas being transmitted and also the heavy external forces exerted by the surrounding water, at a depth of up to 1,000 meters. So the pipe normally has a wall thickness of at least 25mm and is encased in concrete.

Pipes are laid in a continuous length from a huge barge which is built like a steel factory. To avoid welding of pipes underwater, the concrete-wrapped steel pipes are welded on the barge and laid in one length to the seabed.

A typical pipe-laying system carries tens of thousands of pipes each about 12-meter in length. Each section weighs about 10 tonnes in steel alone, and with the reinforced concrete, each section weighs about 20 tonnes.

They are joined together by adding sections to the continuous length of piping, piece by piece, by welding.

As these are high-pressure pipes, special welding techniques are used that include machine bevelling of the tube ends, pre-heated to drive out moisture, and welded by orbital arc-welding machines to ensure the root welds and the filler welds are applied correctly. The welded joints are then inspected by non-destructive testing methods, generally by x-ray, to ensure there are no cracks or cavities.

The welded joints are then wrapped in heat-shrunk synthetic materials to offer long-lasting corrosion resistance to match that of the concrete case of the pipes before launching into the sea.

The continuous piping is then gradually laid to the ocean bed, normally in a lazy S configuration, with long double bends of large radius.

The bending stresses imposed on the pipeline are controlled by tension to prevent buckling. This process is a 24-hour operation, progressing at about four kilometers per day.

As the laid piping are already covered by a layer of gravel, only an inordinately large force, such as an earthquake or undersea explosion, will be able to cause damage to the pipeline. For the pipeline to suffer damage in three or four locations simultaneously is likely to be sabotage.

To gas consumers, whatever the cause, the damage will be detrimental to their gas supplies this winter, as arranging alternative methods of supply will take months, if not years to implement.

Infrastructure investment is extremely costly, in financial terms, time, specialized manpower and technology.

It is extremely important that infrastructure such as pipelines, power and data cables are adequately protected so that we may enjoy the convenience of such expensive and strategically important facilities.

*Veteran engineer Edmund Leung Kwong-ho casts an expert eye over features of modern life*