Corrosion has always been a major problem for the energy industry, regardless of whether in the emerging renewable energy sector or the more traditional fossil fuel industries. In this instance, we are looking at two specific areas of concern: wind turbine towers, due to their extreme locations; and the aggressive corrosion under insulation (CUI) experienced in the petro-chemical industry.

**Wind-turbine Systems**

The wind turbine industry is growing rapidly. In the UK alone there are in excess of 3,000 wind turbines in operation, over 800 under construction, and several thousand more expected to be erected by the year 2020. Many manufacturers of wind turbines specify thermal spray zinc (Zn) or zinc-aluminum (Zn-Al) alloy coatings as a method of corrosion protection. Thermal spray coatings offer a resilient finish, which is less susceptible to damage than many paint coatings. When the size of this growing industry is taken into account, protecting against corrosion is crucial.

Onshore wind turbine towers are commonly manufactured in three or four sections. Each section often is given a metal sprayed coating around the flanged joints and up to 0.5 m (~1.5 ft) on either side of these joints, both inside and out. Many offshore towers are specified to have the entire external surface coated. In addition, areas around the internal bolting fixtures and access hatches are also metal sprayed to provide added protection against assembly damage, as well as protection against general wear and tear. Some wind tower sections can be in excess of 30 m (nearly 100 ft) long, making any corrosion protection process very challenging.

Metal spraying using the Metallisation Arc140 system (Metallisation Ltd., Dudley, West Midlands, UK) makes the entire process much simpler than more traditional metal spray systems. The 20 m (65.5 ft) push/pull supplies package also allows the energizer, wire, and wire-dispensing system to be located outside the tower section, while the operator moves along the inside, spraying where required. This flexibility is also beneficial when spraying the outside of the tower sections, allowing the energizer and wire feed to be kept away from the dusty spray area. The coated sections are then painted to the manufacturer’s specification.

One of Metallisation’s Spanish customers uses automated thermal spray to spray components within the assembly that supports the turbine blades. The actual coating with pure zinc is only one part of the process. In common with all metal spray coatings, the surface of the turbine part is first grit blasted to a profile of around 75 mm and a cleanliness of Swedish Standard SA3 (Surface Preparation - Cast Iron Parts). A robot-mounted arc spray system applies an even 120 mm of zinc at a spray rate of up to 36 kg/h. A final coating of epoxy paint is then applied. This is an excellent way to protect wind turbines from corrosion and offers up to 20 years protection.

**Petrochemical Applications**

In the petrochemical industry, corrosion under insulation (CUI) in piping systems consumes a significant percentage of the maintenance budget. A large portion of this money is spent on expensive items such as external piping inspection, insulation removal and reinstallation, painting, and pipe replacements. CUI prevention strategies provide long-term, reliable pre-
vention of CUI that move toward inspection-free and maintenance-free piping systems and significant maintenance cost reductions.

CUI, where accelerated corrosion can occur under wet insulation, will always be an issue for new pipes and vessels. Coating with TSA (thermal spray aluminum) is an ideal and cost-effective solution compared with other systems when reviewed over the lifetime of the facility. One of Metallisation’s customers, Iris NV, based in Belgium, has embraced the process of thermal spray to protect against CUI with many of its own customers. Iris NV applies thermal spray coatings to new vessels and pipework prior to installation. The preparation of the steelwork surfaces is critical to the success of the thermal spray process. Prior to spraying the distillation columns, the surface needs to be prepared by grit blasting with steel grit to Swedish Standard SA 2.5 (Surface Preparation - Cast Iron Parts), with a surface roughness between 75 and 110 µm. The surface is then arc sprayed with aluminum Grade 1350 to a thickness of 250 µm. Finally, a seal coat is applied to the columns.

As well as new installations, existing insulated pipe and vessels are often protected against CUI as part of an ongoing maintenance and safety regime. It is hoped that maintenance inspection programs can be reduced in years to come through the implementation of a CUI prevention strategy. Pipes are stripped of insulation to enable engineers to inspect the pipework for potential damage and excessive corrosion. A series of nondestructive tests are carried out before the surfaces are grit blasted to SA 3 where possible. In normal circumstances, it is at this stage that TSA will be applied using flame spray equipment, and in some cases, the surfaces are sealed. The final stage is to reapply the insulation to the pipework. This coating solution is increasing in volume, with a number of global oil companies adopting this process within many plants around the world. Confidence in the application process and technique has grown to such an extent that coating of live plant is commonly undertaken.

These few application examples provide some insight into the use of coatings that offer a safe future for the oil and gas industry, as well as supporting renewable energies for a greener long term future.

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