Recent terrorist attacks against critical infrastructure have proved that oil and gas facilities remain highly vulnerable. Wes Moore highlights the importance of effective 24-hour perimeter surveillance, and compares the best available technologies

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Our modern society depends on a constant supply of energy. Petrochemical facilities, oil and gas transmission systems, refineries, utility companies and nuclear plants are all critical infrastructures that need to guarantee this supply. For hostile forces, this infrastructure is also a vulnerable target for attack and, as a result, it requires a very high level of security. Among a range of perimeter security and surveillance measures available, some experts acknowledge thermal cameras to be the best solution for providing 24/7 video surveillance and perimeter security.

Oil and gas refineries are constant targets for sabotage, terrorist attacks or organised criminals threats. Oil and gas

> **"Thermal security cameras can form an integral part of the 'detect, delay, respond' perimeter security strategy"**

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pipeline installations are also extremely valuable assets, situated across extensive regions and traversing borders that are difficult to secure. Attacks or damage to such installations can lead to enormous ecological damage, revenue losses and chaos on international oil markets. Security provides oil and gas companies the freedom to find, develop and manage assets and to deliver supplies without interference.

Many critical sites like oil and gas plants use thermal imaging cameras for perimeter security. These cameras complement an effective mechanical perimeter protection system and work particularly well in combination with video analytics, creating an effective intruder detection system. Thermal cameras typically detect intruders from much greater distances than do comparable CCTV and lowlight cameras.

Force-on-force exercises have repeatedly shown that thermal cameras are the hardest video surveillance technology for intruders to defeat. Security experts throughout the industry agree: thermal security cameras are a highly effective solution for 24/7 video surveillance, as they can form an integral part of the "detect, delay, respond" strategy, designed to give security forces time to locate, contain, and neutralise adversaries before they can access or cause damage.

To be truly secure, daytime surveillance is not enough – a critical site needs to be protected both day and night. Many different technologies are available on the market which can provide this capability, of which thermal imaging is only one. Several different technologies are often combined to create a secure perimeter and to detect intruders both during the day and at night. For example, fences can be complemented with closed-circuit television (CCTV) systems, along with active infrared illumination or old fashioned light bulbs, radio frequency intruder detection (RAFID) systems and/or walking patrols.

Whatever solution or technology is chosen for securing an area, they all have their advantages and disadvantages, and some technologies are more expensive than others. It is important to take into account the total cost of ownership (TCO) for a certain solution – which includes not only the initial purchase cost, but also the installation and maintenance costs required throughout the technology's working life. Some solutions consume a lot of power and need a lot of spare parts, for example – lighting is often inefficient and unnecessary, and can take a significant chunk out of the energy budget. But how do all these different technologies compare? And which technology is most efficient in securing a perimeter in a cost-efficient way?

CCTV systems have traditionally been an effective tool for security and surveillance applications. But CCTV cameras have limited visibility in total darkness. So, in order to detect intruders at night, they are often complemented with traditional mains-powered light bulbs.

Although some bulbs are more efficient than others, the operational cost remains very high. Light can only penetrate a certain distance and completely illuminating an area, so that it can be kept under effective surveillance by CCTV cameras, is not always possible. Powering and maintaining the lights can even be more costly. Furthermore, lighting essentially lays out a route of attack for intruders, creating shadows in which they can hide and access undetected.

Compared to any conventional bulb, LEDs provide significant savings on electrical consumption. LEDs also provide long life performance with little ongoing maintenance costs. Infrared illumination with LEDs, sometimes also called active infrared, beams infrared radiation into the area in front of a camera. The LEDs are often placed around the lens of the camera. LED illumination is compromised by limited range performance, however. Also, providing lighting for domes has long been a challenge for CCTV professionals, as the lighting cannot be fitted to move with the camera.

In order to keep intruders out of certain areas, fences can be constructed. To further increase security, fences can be equipped with sensors that generate an automatic alarm when someone touches the fence. Or they can be electrified, to keep intruders away. In all cases, fences need to be complemented, for example by CCTV cameras or walking patrols, in order to maintain a clear picture of what is happening around the fence.

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Integrated approach: thermal surveillance technology can be used alongside legacy CCTV and other perimeter surveillance systems

The simplest description of radio frequency identification (RAFID) is to consider a system using two specially designed cables – one transmitting a radio wave, while the other receives that wave. Changes in the amount of signal passing between the transmitter cable and receiver cable are analysed by a signal processor. These changes indicate that someone or something is between the two cables, which will trigger an alarm. Due to the difference in signal strength, the system can detect whether these changes are due to the presence of a human or a small animal. In a lot of cases, CCTV cameras still need to be installed in order to see what is generating the alarm and to determine whether it is real or false.

Thermal imaging cameras see thermal energy emitted from an object and thus produce images based on temperature differences between objects. The best thermal cameras produce a crisp image on which the smallest of details can be seen. They work both during daytime and nighttime. Most top of the range thermal imaging cameras contain an uncooled vanadium oxide detector. Not only does this produce excellent quality thermal images, but also it needs virtually no maintenance since it does not contain any moving parts. Thermal imaging technology requires no additional lighting or illumination and has no regular maintenance costs.

With thermal imaging systems, not only are maintenance costs lower (as they require less power and need fewer spare parts, etc), but also already the initial purchase cost of a thermal system is lower than a CCTV system. Although a single thermal imaging camera is more expensive than a CCTV camera, fewer cameras need to be deployed to cover the same area. The civil works that need to be carried out are also minimal. In some cases, the cameras can even be mounted on existing structures. Furthermore, since thermal imaging cameras produce a clear image in the darkest of nights, no complementary technologies like lighting or infrared illuminators need to be installed. Thermal imaging cameras also generate fewer false alarms, which is a common problem with CCTV cameras combined with video motion detection or video content analysis software.

Security professionals around the world have been using thermal cameras for perimeter and critical asset security for years. But facility operations and safety personnel have also been using handheld thermography cameras to gather non-contact temperature measurements and condition monitoring data for decades. Today, both capabilities can be combined in one camera unit.

The latest radiometric thermal imaging technology combines detection capability with the power of temperature measurement to create a multidimensional tool that covers perimeter security and operational predictive maintenance. By calibrating thermal security cameras to measure and display accurate, non-contact temperature measurements, utility companies can measure the temperature of an electrical connection, insulator, cooling regulator, switch, or anything else an alarm can signal when temperature rises to a dangerous level and maintenance needs to be performed. So, with radiometric thermal security cameras, utility companies can receive an even greater return on investment than ever before.

Wes Moore is Director of Marketing for FLIR's commercial security business unit. Since joining FLIR in May 2005, Moore has helped FLIR open and expand commercial markets for thermal imaging, including automotive, marine, law enforcement, security, building and industrial applications. Moore has over 30 years of marketing and advertising experience.