Crops such as aubergines, cucumbers, tomatoes, capsicum peppers and lettuce are now regularly grown in modern greenhouses where light, water, temperature and nutrient supply are well controlled. It is also common to adjust the carbon dioxide (CO₂) levels in greenhouses to create an environment that is optimally conducive to growth. The micro-climate that is created must be monitored and controlled to ensure good growing conditions, avoid expensive over dosing and ensure the safety of the people looking after and harvesting the crops. It is all about finding the sweet-spot for growth, the optimal balance. For food producing and exporting countries, such as Australia and New Zealand, investment in high yield growing processes using a mix of environmental management technologies has been intense in recent decades. Elevated levels of carbon dioxide during the ‘daylight’ growing hours enhance plant growth. In greenhouses, the growth rate and development of all plants can be improved by controlling CO₂ concentrations at levels of around 800 ppm. This is approximately twice as much as the natural concentration of CO₂ in natural ambient air. Higher CO₂ concentrations up to 2000 ppm have been used in greenhouses and hydroponics, but each incremental increase in CO₂ levels above 700 ppm has diminishing benefit to the plants. Despite these diminishing returns, some operators control the CO₂ levels at 1000 or 1200 ppm to fully exploit the potential of CO₂ addition.

Optimised CO₂ levels in greenhouses raise productivity and crop yields considerably, up to 40% during the darkest time of the year. In addition, they also improve the quality of the crop. So, CO₂ can maximise both the crop yield and the sales price for the harvest. This technique is applied to greenhouses using both hydroponic and conventional soil growing techniques.

Creating and avoiding toxic environments
At high levels, CO₂ can be toxic to humans and bugs. For humans, the short-term exposure limit in many countries, including Australia and New Zealand, is 3% by volume (ie 30,000 ppm) and the long term 8-hour time-weighted average exposure limit is 0.5% by volume (ie 5000 ppm). For greenhouse pests such as white fly, exposure to a CO₂ concentration of 1% for one hour has been reported to be an effective fumigation technique. So, it is theoretically possible to use elevated CO₂ levels for pest control in the greenhouse but achieving these high concentrations can be costly and needs to be done when people are not present in the greenhouse, for example overnight. Overnight dosing is possible, but the growth benefits of CO₂ are only realised when applied during ‘daylight’ growing hours. In some growing systems the ‘daylight’ conditions are simulated by artificial electrical light sources such as energy-efficient neon or LED lighting.

Carbon dioxide dosing
In some countries such as New Zealand, it is important to heat the greenhouse to create optimal growing conditions. In Australia on the other hand, for much of the year thermal management means avoiding temperature run-away during peak daytime sunlight hours. This climatic difference has an influence on the CO₂ source. It is possible to burn natural gas or LPG to create both heat and CO₂, which in New Zealand might be an attractive combination. However, in Australia the heat generated by the combustion might be a negative rather than a positive input to the greenhouse environment. In all cases, the generation of CO₂ from combustion also introduces humidity into the greenhouse, which again may be desirable to a certain extent or problematic in extreme cases. The use of direct CO₂ injection has the benefit that CO₂ can be added without the side effects of moisture build up or heat addition to the greenhouse. And, in some situations a mix of sources is used to optimise the range of climatic growing conditions.

TJ Croeser, Sales Manager at the industrial gases supplier Coregas in New Zealand comments: “dosing of carbon dioxide to the greenhouse can be from a CO₂ burner generator, from a carbon dioxide supply cylinder or tank. Greenhouse CO₂ generators are often simple LPG (or propane) burners, which produce CO₂ and heat from combustion of the LPG. However, enhanced flexibility and improved dosing control can be achieved by using carbon dioxide gas, which can be supplied by Coregas in New Zealand in bulk liquid tanks, gas cylinder packs or single cylinders”.

Gas detection - measurement and control
To control the CO₂ level in the greenhouse, an NDIR sensor is typically used. The target set point will generally be 800 ppm of CO₂. When the sensor detects a reduced CO₂ level in the greenhouse it will activate the CO₂ dosing system. When the required CO₂ level has been achieved, the measured value will increase, and the control system will shut off the CO₂ supply. For safety reasons, it may also be desirable to install propane gas...
Gas Detection

ATEX approved modular gas detector offers exceptional flexibility

Gas detection instruments constantly monitor for the presence of toxic and flammable gases along with the monitoring for low oxygen environments. These devices provide constant monitoring of the area in which they are installed. Should hazardous gases within the surrounding air exceed permitted levels, signals are sent to the control and monitoring panels and the warning and evacuation procedures are initiated. Each system however requires different parameters such as output types, communication protocols and display options. A need for a modular device with the capability of adding and removing such functions/features is now more demanding than ever in order to be able to cover most projects including the ones with tight budgets.

The Silversafe 500 is the latest ATEX approved modulargas detector offered by Silver-Tec which enables tailored functionality to meet project requirements at an optimised cost. Spending money on extra features that is not needed by the project is what Silversafe 500 is designed to avoid.

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Analytical Technology’s pioneering AutoTest feature is the ONLY Gold Standard in gas detection available, making it the safest gas monitor in the world.

ATi’s patented design automatically checks itself daily with self-generated gas, allowing for safer and more confident monitoring far exceeding any current and potential health and safety regulations.

unique feature is designed to detect and monitor potentially hazardous toxic and flammable gas leaks, to ensure the safest possible working environment. It provides an early warning alarm if gas escapes, allowing for timely remedial or protective actions to be undertaken.

Conventional gas detection systems require costly manual ‘bump tests’ and annual service contracts, however ATi’s new generation, highly intelligent AutoTest feature offers peace of mind, knowing that it is functioning daily.

ATi’s innovative AutoTest technology is set to revolutionise the way gas detectors of the future work. With both safe area and ATEX approved equipment, toxic and flammable gas detection need never again be a guessing game. Companies can now rest easy, knowing their safety systems are working 24/7. More information online: ilmt.co/PL/L1L9

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Gas Detection

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And with the last word to Croeser of Coregas NZ on the topic of safety: “Let’s put the undisputed economic benefits of CO2 closing to one side for a moment and get down to brass tacks... there is nothing more important in that greenhouse than the gas detectors and alarm system. Every employee relies on it for their safety. Carbon dioxide is invisible and does not have a noticeable smell, so a dangerous concentration can’t be detected by humans until it’s too late. The same can be said for propane from gas cylinders. That’s why we offer only the best quality NATA-certified calibration gas mixtures for gas detector sensor calibration applications.”