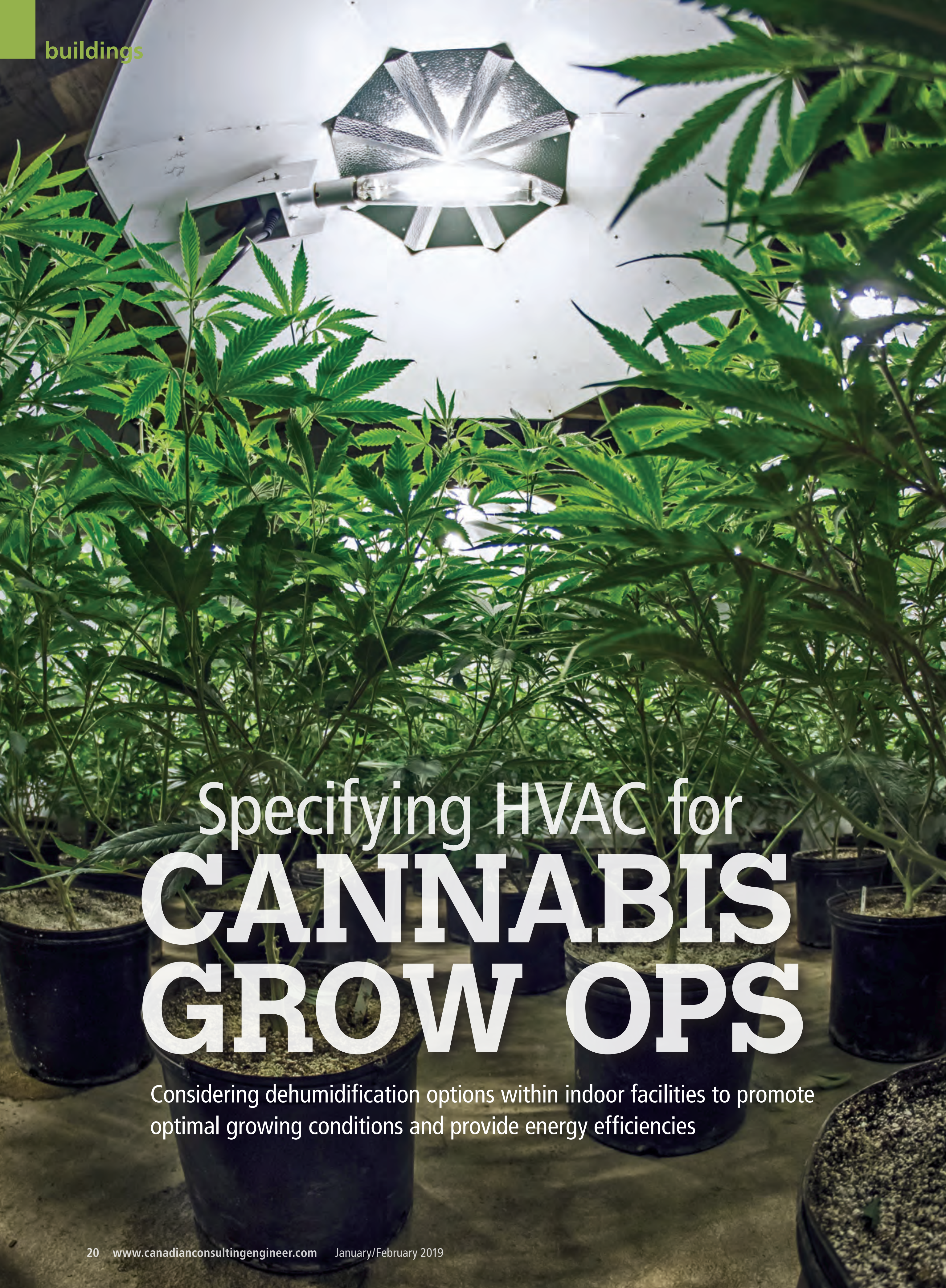

Specifying HVAC for CANNABIS GROW OPS

Considering dehumidification options within indoor facilities to promote optimal growing conditions and provide energy efficiencies

By Geoff Brown and Ralph Kittler, P.Eng.

For consulting engineers the question is no longer "if," but "when" they will design a system for a cannabis growing facility.

If Health Canada's recent cannabis prediction statistics prove true, designing a new construction or retrofit cannabis grow-op HVAC system in 2019 is almost guaranteed for most Canadian mechanical consulting engineering firms in the very near future.

Health Canada estimates that Canadian growers need to expand their grow areas by 14 to 15 million square feet to meet cannabis needs in 2019 thanks to last October's cannabis law reforms that have expanded from medical use to now include recreational use.

Previously, cannabis grow-op facility managers believed growing spaces required only sensible cooling and that humidity wouldn't prove problematic once the lights were turned off half of the day during the flowering cycle. They were wrong.

Conventional air conditioning is fairly adequate for handling the sensible heat loads when the lights operate. However, when lights are off, air conditioning technology falls well short of handling the heavy remaining latent loads without overcooling.

Furthermore, air conditioned grow-ops were paying a large reheat energy penalty to maintain temperature. High humidity levels also stunted crops and lost entire plants to mold. Many were forced to supplement with portable dehumidifiers, which raised energy costs further.

Recently, growers have realized similarities between grow-ops and indoor swimming pool environments, because they shared similar latent load handling requirements.

Indoor swimming pool mechanical dehumidifier technology, which was invented in the 1970's, enabled the skyrocketing emergence of natatorium design in the 1980's and 1990's and now encompasses an entire design chapter in the ASHRAE Handbook.

Pool dehumidifiers recirculate humid natatorium air through deep dehumidification/cooling coils to remove moisture and then can efficiently reuse compressor waste heat to heat the pool water or reheat the processed air as needed. In a grow-op design, the heat recovery can be used when the lights are off to efficiently reheat the dehumidification coil's cold discharge air without employing costly gas-fired or electric heat.

While latent heat loads are challenges, another design obstacle is the fact most grow-ops typically operate four separate areas all requiring different humidity and temperature set points.

Typically a grow op will have cloning, vegetation, flowering and drying rooms. Humidity can range anywhere from 55 to 75 relative humidity (RH) from one room to another. Tight tolerances of ±1-percent can affect final productivity.

Adding to the challenge is the fact that no standards or recommendations for grow-ops have been established from organizations such as the American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE). However, ASHRAE and the American Society of Agricultural and Biological Engineers (ASABE), have recently begun working jointly on a grow-op guideline.

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Consulting engineers have basically four types of dehumidifier concepts that can be employed in a grow-op.

Compact Units—applicable for more than 100 square feet, and multiple units can efficiently condition up to 2,000 square feet of space. These lightweight, portable units operate without ductwork and can remove up to about 500 pints/day. They are generally reheat dehumidifiers with no capacity for cooling. The disadvantage is their discharged compressor heat creates an energy penalty for removal within the space. Thus, they're only ideal as supplemental units for spaces using conventional air

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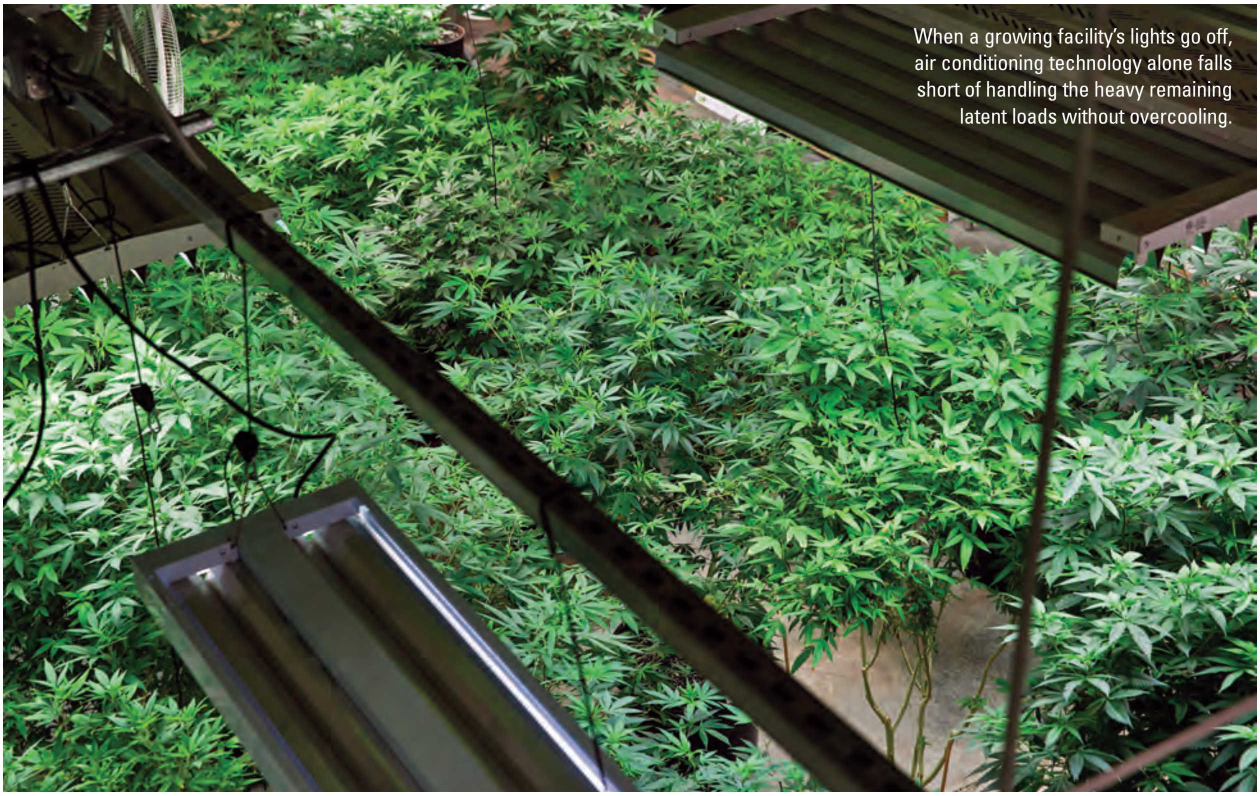

When a growing facility's lights go off, air conditioning technology alone falls short of handling the heavy remaining latent loads without overcooling.

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conditioning that is unable to handle the humidity loads. Generally, they're designed to fix a sensible cooling-only room's inadequacies.

Larger Units—applicable for medium-sized rooms of up to 10,000-square feet requiring up to 100-lb/hr moisture removal and up to 8,000-CFM. These packaged dehumidification/cooling units are designed for relatively smaller areas that require space-saving rooftop systems. They can be ducted or simply downflow discharged into a room from their rooftop position. Sophistication can range up to monitoring/controlling with web-based browsers and smartphone apps. These and other rooftop systems are infrequently specified, because many grow spaces are retrofitted industrial or warehouse spaces not designed with heavy weight-bearing roofs that can support large HVAC systems.

Largest Units—applicable for new plan/spec construction projects with capacities ranging up to 800-lbs/hr moisture removal and up to 70,000-CFM for very atypically large grow buildings. Generally they are specified as one large unit when there is enough property space to accommodate a ground-mounted system to save indoor space and circumvent the expense of heavy-duty roof structures that would support rooftop units. They provide cooling, heating and dehumidification and their designs, capacities and operating sequences are very similar to indoor pool environmental systems. They are packaged or split systems (with dry coolers) that distribute air through ductwork that is many times fabric air dispersion systems to remain under the weight-bearing capacity of the roof.

Medium Units Used in Tandem—applicable for any size grow-op room supplying nearly unlimited moisture removal capacities and CFMs, because they can be used in tandem in medium to large rooms. Generally, they are split systems with indoor dehumidifying capabilities. They can be located in a cooling mechanical room or corridor that distributes air into the space through ducts. It can use heat recovery for reheat or reject heat to outdoor dry coolers. These too can offer web-based browser monitoring and controlling from a remote dashboard or smartphone app. Alarms, historical data recording and remote factory technician access are just a few of the advantages of the control and software sophistication.

As the grow-op building boom develops across Canada, engineers may find this final option, medium units used in tandem, to be the most preferred and flexible for specification, especially in new construction.

Grow-op HVAC options should include built-in redundancy, such as dual compressors and dual air pass designs, so each can independently dehumidify the space in the event its counterpart requires service.

Cannabis plants can survive a couple of days of darkness, but not high humidity.

Scalability is also important because the grow-op business is expected to expand exponentially. Engineers tend to specify medium sized units, versus one large system, because multiple units can operate in tandem for any size facility or provide custom humidity/temperature set points for specialty rooms.

Systems that minimize refrigerant leak liabilities with reduced refrigerant equipment, such as glycol run-around loops for heat rejection to dry coolers, will undoubtedly be favored by grow-op managers once the methodology becomes known in the industry. Refrigerant leaks in grow rooms will damage or destroy crops. The system's mandatory refrigerant circuit for dehumidification and cooling should also be factory sealed to avoid on-site charging errors.

As the investment community's interest in cannabis continues to grow, it will be the engineer's responsibility to help grow-op managers navigate the trade-offs of cost versus performance.

Investors will undoubtedly continue pushing toward less expensive equipment, such as conventional air conditioning, versus more performance-oriented equipment with commercial dehumidification to handle the grow-op industry's significant latent loads. However, performance versus cost will reap energy-saving dividends in the long term.

Therefore, it should be the consulting engineer's responsibility to educate grow-op operation managers on the type of equipment that will generate both performance, reliability and long-term energy-efficiency goals without sacrificing crop quality. **CCE**

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