



Energy Management Best Practices for Cannabis Greenhouses and Warehouses

This report identifies how Ontario's indoor cannabis sector uses energy and discusses energy efficiency opportunities for cannabis operations, policy makers and utilities.

About the Study

The legalization of recreational cannabis has generated a new sector with significant energy needs. This emerging industry is creating a need for leaders in cannabis operations, policy makers and utilities to better understand the energy requirements of the sector and find ways to manage increased demands on energy systems.

To support that understanding, the Independent Electricity System Operator (IESO) collaborated with the Centre for Energy Advancement through Technological Innovation (CEATI), along with utilities in two Canadian and three United States' jurisdictions on the development of a new report, **Energy Management Best Practices for Cannabis Greenhouses and Warehouses**. This work builds on the findings from the *Ontario Greenhouse Energy Profile* study published by the IESO in October 2019 and will inform future energy-efficiency activities to support this important new sector.



Overview

Ontario's indoor cannabis sector is booming, increasing its demand for energy.

No matter how you grow cannabis, it takes a lot of energy.

Standard energy management practices are still challenging for the indoor cannabis sector for a few reasons. First, it's still a relatively new industry in many North American jurisdictions, including Ontario. Second, every facility and its growing needs is unique. Finally, while codes and standards do exist in some jurisdictions, there are no unifying standards or protocols for cannabis growers that offer a comprehensive guide to optimal equipment combinations or control strategies.

Despite these challenges, opportunities to save energy – and reduce electricity costs for operators – exist for the indoor cannabis sector.

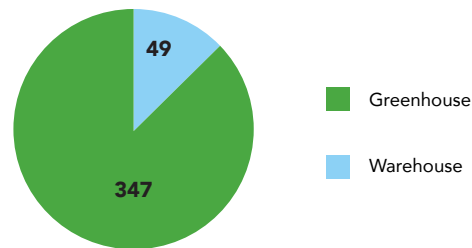
Snapshot: Ontario's Cannabis Sector

There were an estimated 396 indoor cannabis facilities in Ontario at the end of 2019.

Commercial indoor cannabis facilities include warehouses and greenhouses, both of which are energy intensive. Warehouse facilities use only artificial light, while greenhouses use a combination of artificial lighting and sunlight. Compared to greenhouses, warehouses can offer a higher degree of environmental control. Warehouse grow rooms, for example, are sealed from the outdoor environment and provide plants with artificial light, mechanical cooling and dehumidification. These facilities tend to have high construction and operating costs relative to greenhouses.

The vast majority – 90 per cent – of indoor cannabis operations in Ontario are greenhouses.

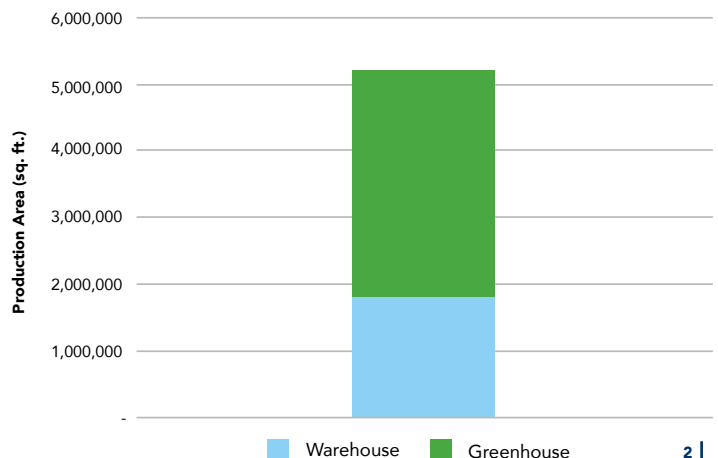
Number of Indoor Cannabis Facilities in Ontario (2019)



Greenhouses make up 65 per cent of the total area of cannabis facilities.

Greenhouses also make up more of the total area for indoor cannabis production (65 per cent, with warehouses making up the remaining 35 per cent). Combined, both types of facilities span 5.2 million square feet, which is expected to increase in the next few years.

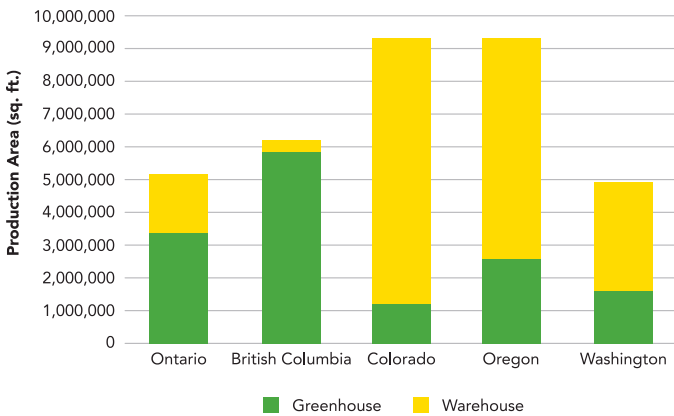
Production Area of Indoor Cannabis Facilities in Ontario (2019)



Acreage of Indoor Cannabis by Jurisdiction

Of the five jurisdictions studied, Ontario and British Columbia have a majority of acreage in greenhouse operations, whereas Colorado, Oregon and Washington grow primarily in warehouses.

Area of production in square feet per jurisdiction

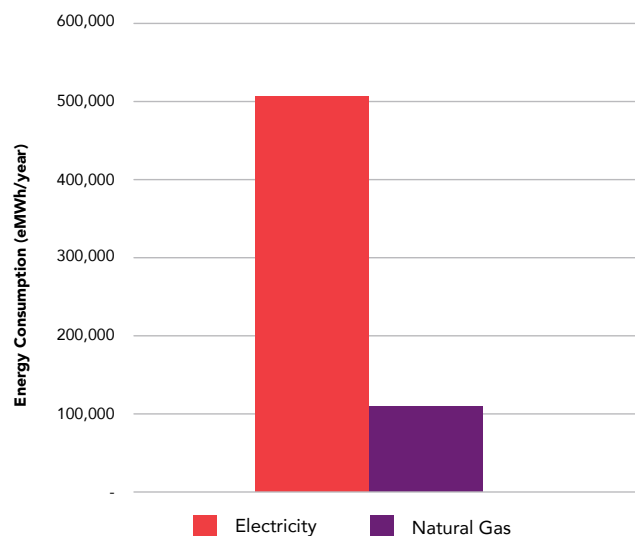


Overall, cannabis facilities use far more electricity than natural gas.

While most indoor cannabis facilities use both natural gas and electricity, their electricity use is much higher. In 2019, Ontario cannabis facilities used 500,000 eMWh* of electricity compared to 100,000 eMWh of natural gas.

That's enough energy to power more than 110,500 Ontario homes in a year, on average.

Annual Cannabis Facility Energy Use by Energy Type (2019)



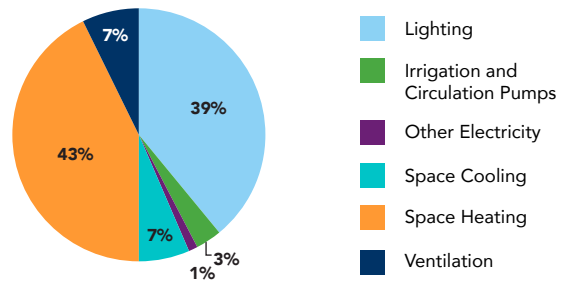
Greenhouses vs. Warehouses: What's Driving Energy Use?

Electricity powers all end uses in both greenhouses and warehouses, except for space heating. The fuel share for space heating is assumed to be 50 per cent natural gas and 50 per cent electricity for warehouses, and 85 per cent natural gas and 15 per cent electricity in greenhouses.

For both types of facilities, lighting is a major driver of overall electricity consumption, but heating and cooling needs differ.

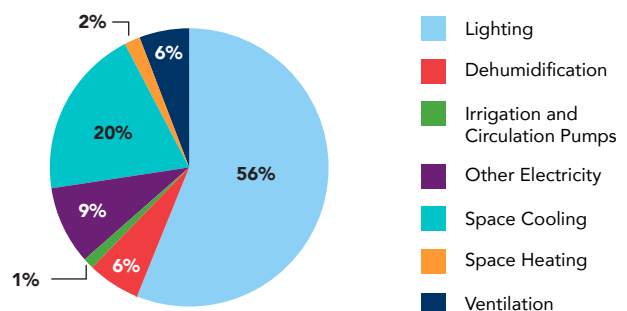
In greenhouses, lighting, space heating and ventilation are the biggest drivers of overall energy consumption (natural gas is primarily used for heating needs). Most greenhouses do not have mechanical dehumidification and instead use natural or passive ventilation to control humidity, so dehumidification's impact on energy consumption is negligible.

Energy Use in Ontario Cannabis Greenhouses



Warehouses, on the other hand, consume more energy for lighting, space cooling and dehumidification. Warehouses require less energy for space heating, since they have higher internal heat gain. Unlike greenhouses, most of the heating load in warehouses is associated with reheating conditioned air for dehumidification.

Energy Use in Ontario Cannabis Warehouses



The Energy-Efficiency Opportunity

Both greenhouse and warehouse cannabis operations have potential to conserve electricity and manage energy more efficiently.

1. LED lighting presents the greatest energy-saving opportunity.

High-pressure sodium lighting (HPS) is still the standard in the cannabis sector. Given that lighting drives much of the electricity use in both kinds of cannabis production facilities, upgrading HPS lighting to LED lighting presents the single most significant energy-saving opportunity. This is true across all the regions studied, including Ontario.

2. Create a balanced system for optimal growth.

Replacing HPS with LED lights in indoor cannabis facilities can create offsetting electricity increases. Although less electricity is required for lighting, less overall heat is transferred by the lighting, so more heating is required.

In greenhouses: The reduced convective and radiative heat transfer from LED lights needs to be compensated for by the gas heating system. That means electricity savings occur, but gas consumption increases. However, overall energy consumption remains lower. Energy curtains – thermal screens or barriers engineered for horticulture environments and placed around walls – also offer the greatest opportunity for natural gas savings in greenhouses.

In warehouses: These facilities have high internal heat gains and predominately meet dehumidification reheat load with electric heat. This means electricity savings from LED lighting are almost entirely offset by the need for electric heating, so there are virtually no material energy savings, unless a heat recovery system is in place.

3. Implement additional measures as needed.

Along with upgrading lights and taking into account interactive effects on the HVAC system, there are several additional energy-efficiency measures that may help to conserve energy in greenhouses and warehouses as shown in the table below.

Energy-Efficiency Measures in Cannabis Greenhouses and Warehouses

Greenhouses	Warehouses
Variable frequency drives on supply and exhaust fans	Chillers (air cooled and water cooled)
Condensing boilers	Dehumidifiers
Condensing unit heaters	Direct expansion unit gas heating
Energy curtains (natural gas savings)	Waterside economizers



* Charts displaying both electricity and gas converted to equivalent MWh use eMWh. The eMWh or “equivalent megawatt hour” is a measure to show the equivalent energy use for both electricity and gas.



Next Steps

Take advantage of the Save on Energy Retrofit program.

The IESO offers Save on Energy programs to businesses so they can benefit from newer, more energy-efficient equipment. For indoor cannabis operations, this includes incentives for LED top-lighting and inter-lighting. To find out more, visit: [SaveOnEnergy.ca/Agriculture](https://www.ieso.ca/SaveOnEnergy.ca/Agriculture), call the Save on Energy Support line at 1-844-303-5542 or email: Retrofit@ieso.ca.

Participate in the regional planning process.

Local input provides a strong foundation for regional electricity planning, ensuring the unique needs of an area are taken into consideration as the IESO plans for the future. Find out about the IESO's engagement initiatives on the Regional Planning and Community Engagement section of the [IESO website](#).

Read the 2021 Energy Management Best Practices for Cannabis Greenhouses and Warehouses.

Read the 2019 Ontario Greenhouse Energy Profile Study.

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