

Pharmaceutical Manufacturing

Pathways to a Competitive Low-Carbon Future



Sector Overview

NAICS Codes: 3254 – Pharmaceutical and Medicine Manufacturing (also relevant for 541710 – Research and Development in the Physical, Engineering and Life Sciences)

The pharmaceutical manufacturing industry consists of companies that develop and produce medicines and related products, for humans or animals, in large volumes for sale to hospitals, pharmacies, and the public. This includes formulation and finished dosage manufacturing, as well as active pharmaceutical ingredient (API) and biologics manufacturing. Companies range from large in-house facilities owned by multinational pharmaceutical firms to contract development and manufacturing organizations (CDMOs). In Canada in 2024, the sector included approximately 771 establishments, employed over 35,000 people, and is concentrated in Quebec, Ontario, and British Columbia. [1] [2]

Energy Use & Emission Sources

GHG Emissions: 0.25 Mt CO₂eq (0.04% of Canada's emissions) [3]

Most pharmaceutical manufacturing companies in Canada are not large direct emitters. The most emissions-intensive part of the supply chain, API manufacturing, occurs largely outside Canada. Energy use is dominated by heating, ventilation, air conditioning and refrigeration (HVAC/R), roughly 70% of on-site energy, due to strict climate and air quality requirements. Direct emissions come from natural gas for steam and space heating and from refrigerant leakage; electricity supplies fans, chillers, lighting, and process equipment, with indirect emissions depending on grid carbon intensity. Indirect emissions can be much larger than direct emissions, particularly from purchased raw materials, product and employee transportation, packaging, and downstream product use, notably from metered dose inhalers (MDI).

Key Emission Sources & Decarbonization Actions

1

HVAC/R Systems

Direct Emissions



Description

Ventilation required for clean rooms and fume hoods, make-up air units, chilled water, hot water and steam for manufacturing processes, space heating and cooling, refrigeration.

Key Actions

- » Replace fossil-fuel heating systems with electric heat pumps and reduce heating demand with waste heat recovery.
- » Transition gas-powered absorption chillers to electric systems and upgrade air conditioners to heat pumps.
- » Optimize air change rates and reduce ventilation energy demand with variable air volume systems.
- » Replace high-global warming potential (GWP) refrigerants with lower-impact alternatives.

2

Plug Loads & Processes

Direct & Indirect Emissions



Description

Lighting, lab and bulk manufacturing equipment (mixers, centrifuges, motors), sterilization and drying equipment, water heating, forklifts, and other non-HVAC electrical or fossil fuel loads.

Key Actions

- » Electrify steam and heat processes using electric boilers or heat pumps and reduce heating demand with waste heat recovery.
- » Reduce energy demand by upgrading chillers, dryers, motors, and lighting to high-efficiency models, installing smart-sensors, and implementing energy management systems.

3

Raw Materials

Indirect Emissions



Description

Manufacturing of APIs, excipients (non-active ingredients), bulk chemicals, and biological products.

Key Actions

- » Procure raw materials from low-carbon suppliers.
- » Apply green chemistry principles and process efficiency improvements when manufacturing raw materials on-site.

4

Downstream Use of MDIs

Indirect Emissions



Description

MDIs use hydrofluorocarbon (HFC) propellants, which are potent greenhouse gases released when patients use

Key Actions

- » Offer alternatives such as dry powder inhalers or soft mist inhalers where clinically appropriate.
- » When MDIs are necessary, provide smaller-volume relievers.

the device for respiratory diseases such as asthma.

- » Collaborate with physicians and pharmacists to improve patient education on use and disposal.

5

Product & Material Transportation

Indirect Emissions



Description

Refrigerated ground vehicles, temperature-controlled vans, and cold chain containers via air, rail, and marine freight for inbound materials and outbound product distribution.

Key Actions

- » Switch short-haul and last-mile vehicles to electric alternatives as they become available.
- » Optimize routes and shipment loads to reduce unnecessary fuel use.
- » Prioritize rail and marine over air freight.
- » Switch to lower-GWP refrigerants in refrigerated transport units.

6

Employee Transportation

Indirect Emissions



Description

Daily commuting and business travel by car, rail, or air.

Key Actions

- » Encourage public transit, walking and biking to facility.
- » Support electric vehicle adoption with on-site chargers.
- » Encourage remote work and virtual meetings.
- » Prioritize rail over air travel for short journeys.

7

Packaging

Indirect Emissions



Description

Plastics, glass, aluminum, and paper used for syringes, vials, blister foils, IV bags, and other product packaging.

Key Actions

- » Reduce unnecessary packaging.
- » Transition to packaging that can be re-used or recycled and where possible replace petroleum plastics with biodegradable alternatives, cardboard, aluminum, or glass.
- » Seek out packaging from low-carbon providers.

Growth & Competitiveness Benefits

Market Growth

Early movers on decarbonization are better positioned to capitalize on trade opportunities as international partners and customers increasingly apply climate criteria to procurement decisions. Operational costs can be reduced by prioritizing cost-saving mitigation measures (e.g., energy efficiency). Many major Canadian pharmaceutical companies have already made emissions commitments through the Net-Zero Challenge or the Science-Based Targets Initiative. The World Health Organization is also calling for pharmaceutical companies to reduce their environmental impact, signalling that regulatory pressure is likely to grow.

Brand Reputation & Leadership

A credible net-zero strategy strengthens relationships with clients, investors, and institutional buyers, and signals that a company is managing future risk responsibly. In a sector where credibility and trust are foundational, demonstrated climate leadership reinforces brand value and supports talent attraction and retention.

Additional Resources

Pharmaceutical Manufacturing Net-Zero Primer →

See our full primer developed in collaboration with Environment and Climate Change Canada to get started.

GHG Protocol →

Guidance on calculating Scopes 1, 2, and 3 emissions and communicating results consistently.

ISO 14064 →

International standard to quantify, report, and verify GHG inventories by third parties.

Net-Zero Challenge →

Voluntary net-zero commitment program from the Government of Canada.