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# Commercial readiness of building decarbonization technologies in large-scale real estate: a Canadian perspective

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# Key pillars of building decarbonization

## Sustainable construction

Low-carbon concrete; Mass timber construction; Prefabricated building components; High-performance building envelopes; Recycled and upcycled construction materials; Green roofs and living walls; Passive solar design; Structural insulated panels (SIPs); Aerogel insulation; Phase change materials for thermal management; Self-healing concrete; 3D-printed building components; Modular construction systems; Geopolymer cement; Transparent wood composites

## Smart building systems

Building Management Systems (BMS); IoT-enabled sensors and controls; AI-driven HVAC optimization; Smart lighting systems with occupancy and daylight sensors; Energy monitoring and analytics platforms; Automated fault detection and diagnostics; Smart meters and submetering systems; Integrated security and access control systems; Predictive maintenance software; Digital twin technology for building operations; Smart window systems; Demand-response enabled appliances and systems

## Residential solutions

High-efficiency heat pumps; Smart thermostats; Energy-efficient appliances; LED lighting with smart controls; Home energy management systems; Solar PV systems with battery storage; High-performance windows and doors; Spray foam insulation; Heat recovery ventilation systems; Smart water heaters; Dual-fuel heating systems; Radiant floor heating; Zoned HVAC systems; Smart power strips and plug load controllers; Residential energy monitoring systems

## Commercial building optimization

Building automation systems (BAS); Chiller plant optimization; Variable air volume (VAV) systems; Demand-controlled ventilation; LED retrofits with advanced controls; Retro-commissioning and continuous commissioning services; Energy management information systems (EMIS); High-efficiency boilers and furnaces; Variable frequency drives (VFDs) for motors and pumps; Thermal energy storage systems; Building envelope upgrades; Heat recovery systems for HVAC and industrial processes

**Note: Examples of relevant climate technologies included, prioritizing those with high Technology Readiness Levels (TRLs).**

# Decarbonization commitments and strategies of major firms

| Company | Net-zero target | Decarbonization initiatives | [illegible] |
|---|---|---|---|
| FLUOR | 2023 (scope 1 and 2) | "Building a Better Future" strategy focusing on energy transition; targeting decarbonization projects in hard-to-abate sectors (cement, steel) | [illegible] |
| AECON | 2050 (scope 1, 2 and 3) | Aecon Green Energy Solutions division for renewable and efficiency projects; Pilots with innovative materials (CarbiCrete) | [illegible] |
| AECOM | 2040 (reduce scope 1, 2 and 3 emissions by 90% and offset the rest through high quality carbon removal projects) | Sustainable Legacies strategy; ScopeX™ carbon reduction framework integrated into all designs | [illegible] |
| JLL | 2040 (scope 1, 2 and 3) | Portfolio Sustainability Program for clients; Carbon Pathfinder software and data analytics; Green leasing and tenant engagement | [illegible] |
| Jacobs | 2040 (reduce scope 1, 2 and 3 emissions by 90%) | Climate Action Plan (every project a climate opportunity); reduce scope 1 and 2 emissions 50% by 2030, and scope 1, 2 & 3 emissions 90% by 2040; Digital twin and "Evolve" sustainability tool | [illegible] |
| BECHTEL | 2050 (scope 1, 2 and 3) | Decarbonization Task Force & client advisory; Investing in renewable energy and green hydrogen projects; Internal carbon pricing for proposals | [illegible] |

Note: Scope 1: Direct emissions from owned or controlled sources (e.g., company vehicles, machinery); Scope 2: Indirect emissions from purchased electricity, steam, heating, and cooling; Scope 3: All other indirect emissions in the value chain, including suppliers and clients.

# Climate Tech Market Map for the Built Environment by Climate Insider

## Residential and Commercial Solutions

### HVAC

SkyCool Systems, HT Materials Science, TES Thule Energy Storage, microEra Power, EVERCLOAK, CHROMASUN, CONRY, AMBIATOR

### Renewables

powerdiverter, mylight 150, 1K5°, dcbel, SUNROOF, Naked Energy, YouSolar

### Storage

POWERVAULT, AllGrid, sonnen

### Resilience

PREVISICO, junglefy

### Analytics

DABBEL, tallarna, BRAINBOX AI, CAALA

## Smart Buildings

SageGlass, eufy, wattio, Bisly, SwitchBot, tado°, vilisto, emporia, HYDROGEN ATM, Grid Edge, 75F

## Sustainable Construction

### Building Material

TILE Green, Brite, junglefy, BIOMASON, AISTI, CCB Greentech, PARTANNA, hexas, ekoa, ECOVON

### Carbon Management

granular energy, DABBEL, One Click LCA

### Waste

urban machine, JUUNOO, FenX, oxara, ECOBRICKS, MYCOCYCLE

### New Processes

Qflow, tvasta, OptiStructure, hyperion, BIOHM, innotech, BLACK BUFFALO, Curvecrete, unity homes, 011h, plant PREFAB

### Concrete Manufacturing

CarbiCrete, BETOLAR

### Steel Manufacturing

BOSTON METAL, fēro labs

# Best practices for effective building decarbonization

## Key strategies

- **Lifecycle approach**:
  Address carbon at all phases, from materials to operations, avoiding costly inefficiencies.
- **Data & smart tech**:
  Use AI, IoT, and analytics for real-time energy tracking and optimization.
- **Policy & incentives**:
  Leverage government support and align with evolving regulations for market advantage.
- **Partnerships**:
  Collaborate across sectors to drive innovation and cost-sharing in retrofits.
- **Risk management**:
  Perform climate risk assessments and adapt corporate strategies accordingly.
- **Skills & culture**:
  Train teams in sustainability-focused skills and incentivize carbon reduction.

## The Canadian context

Canada's **strong policies enable decarbonization**, but **regional challenges** (cold climate, aging buildings, grid differences) require **tailored approaches**. Proven solutions exist; therefore, the **priority** is **scaling deployment.**

## Outlook

Decarbonization is an **opportunity**, not just compliance. Efficient buildings **lower costs, improve occupant satisfaction,** and **enhance asset value. Leadership and collaboration** will be **key** in turning commitments into real emissions reductions.

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