

ESG Matters

Vertical Farming

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Vertical farming is energy intensive, but likely to play a bigger role in the global food solution. This article describes vertical farming, its benefits and companies with exposure to the vertical farming market.

Vertical farming may be poised for a breakout

Vertical farming is the practice of growing crops indoors in stacked layers under LED lights, often using artificial growing systems such as hydroponics, aquaponics or other forms of soilless agriculture. It was conceived in the early 2000s and has since been heralded as everything from the future of farming to an expensive distraction. Although vertical farming has not grown in a way that is commensurate with its promise, we think it may be poised for a breakout due to increasing deal activity and the market's growing awareness about the substantial environmental impacts of conventional farming techniques.

Walmart's entry into the market could be a positive catalyst

Walmart disclosed on January 25, 2022, that it had joined One Madison Group, JS Capital, and SoftBank in a [US\\$400 million funding round for Plenty](#), a U.S. based vertical farming pure play. We think the deal is likely to catalyze increased investor interest in the vertical farming sector given Walmart's cache in the grocery business, but it is far from the only positive indicator. Precedence Research expects the global vertical farming market to reach [US\\$31 billion by 2030](#), up from ~ US\$4 billion in 2021. According to consulting firm Agritecture, [74 vertical farming start-ups were founded in 2020](#) (data for 2021 not yet available).

Vertical farming is likely to benefit from sustainability tailwinds...

As shown in Exhibit 1, vertical farming offers numerous sustainability benefits over conventional farming, and we believe these advantages are likely to be amplified due to the market's increasing awareness about the environmental impacts of traditional agriculture (food production accounts for [70% of global water use](#) and 25% of global greenhouse gases ("GHGs"), and is a major driver of biodiversity loss, deforestation and soil degradation).

...but it is not a panacea.

Vertical farming's Achilles heel is that it is energy intensive; a recent study in the UK found that a square metre of lettuce in a vertical farm [needs up to 3,500 kWh/year](#) compared to 250kWh/year in a traditional greenhouse. However, there are indications that this delta is closing, and the emissions associated with this additional electricity use may diminish over time as countries pivot to renewables.

Exhibit 1: Benefits of vertical farming

Benefits	Description
Water efficiency	Vertical farming uses ~95% less water than traditional farming because water is recycled and flows in a closed-loop.
Reduced chemical use	Vertical farming requires significantly less fertilizer, pesticides and herbicides, all of which have high carbon footprints (particularly fertilizer).
"Compressed supply chain"	Vertical farming can be located near urban centres and end markets, thus reducing transportation costs, supply chain emissions and food waste.
Higher productivity	According to the USDA, vertical farming can deliver 10-20x higher yields for some crops vs. open-field.
Smaller land footprint	With crops housed in towers and grown on top of each other, vertical farming generates significantly reduced deforestation, soil degradation and biodiversity loss than conventional farming.
Year-round crop production	Vertical farms grow crops indoors using technology to create ideal growing conditions so are not subject to external weather, thus enabling year-round crop production.

Source: Sustainfi, Vertical Farming Planet, USDA, BMO Capital Markets

Investing in vertical farming

In Exhibit 2 we display companies with involvement in vertical farming technologies, including publicly-traded pure-plays, private firms, and Walmart as an indirect play on the theme. Vertical farming remains an emerging technology and the sector is currently dominated by micro- and small-cap players.

The bigger picture

The drawbacks facing vertical farming are palpable – we have cited the industry’s high energy needs, and to this we can add high start-up costs, the need for specialized skills and the limited number of crops that can currently be grown economically. Still, vertical farming offers compelling sustainability benefits that we think are going to become more financially relevant over time. The bigger picture is that the Earth’s population is projected to reach [9.7 billion in 2050](#), up from 7.9 today. Coupled with other factors, such as increasing per capita caloric consumption, the Food and Agriculture Organization estimates that food production will need to [increase by 50-70% from current levels](#) to meet global food demand in 2050. Given the significant environmental impacts and ecosystem stress driven by conventional food production, we think several agricultural technologies, including vertical farming, are likely to play a bigger role in developing sustainable food solutions in the future.

Exhibit 2: Companies with exposure to vertical farming

Company	Ticker	“Market Cap (US\$ millions)”	Description
Agrify Corp	AGFY-NASDAQ	143	Provider of vertical farming technology
AppHarvest	APPH-NASDAQ	303	Developer and operator of vertical farms
CubicFarm Systems Corp*	CUB-TSE	185	Provider of vertical farming technology
Hydrofarm Holdings	HYFM-NASDAQ	856	Manufacturer and distributor of vertical farming equipment and supplies
Kalera AS	KSLF-OTCMKTS	147	Developer and operator of vertical farms; announced merger with Agrico Acquisition Corp, a Nasdaq listed special purpose acquisition company
Local Bounti Corp.	LOCL-NYSE	464	A controlled environment agriculture operator that utilizes a hybrid of vertical farming and hydroponic greenhouse farming
McCain Foods Ltd.	Private	N/A	Invested CDN\$65 million in GoodLeaf Farms, a vertical farm in Guelph, ON
Walmart	WMT-NYSE	386,179	Recently participated in a US\$400 million investing round in Plenty, a vertical farming company with vertical farms in San Francisco and Compton, California and an indoor plant science research facility in Laramie, Wyoming

Source: Company reports, FactSet, BMO Capital Markets. Market cap data as of February 8, 2022. *CubicFarm Systems Corp in C\$.

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