The term Controlled Environment Agriculture (CEA) typically refers to the processes in which crops are grown indoors using artificial (electric) light and soil-less techniques such as hydroponics, aeroponics, and aquaponics. The plants are typically grown in trays stacked vertically on tiers, so there are several layers of crop. CEA facilities that use more than one growing level can be referred to as vertical farms (VFs).

CEA’s current principal crops are leafy green vegetables, which are not significant sources of calories to combat hunger, but can provide abundant healthy micronutrients. While CEA currently plays an extremely small role in the grand scheme of agriculture, certain proponents of the industry predict a future in which CEA will provide most fresh produce for cities in the long term, and perhaps even cereals and other foods in the longer term. The main benefits of CEA compared to conventional agriculture include the following:

1. Elimination of our increasingly-unstable climate and weather as risk variables
2. Infinite growing season: cultivation regardless of seasonality
3. Economy of space: dramatically increased density of crops per square meter
4. Economy of time: increased rates of plant maturity (faster harvests)
5. Economy of water: significantly lower requirement in CEA than in fields
6. Economy of nutrients: significantly lower requirement in CEA than in fields
7. Healthier produce: elimination of biocides
8. Fresher produce: urban locations minimize time and distance between harvest and consumption- improved flavor, nutrient content, and reduced fuel for transportation
9. Land use shift: possible reutilization of vacant commercial/ industrial real estate; ecological upgrading of former monoculture plots

Most VFs still face financial challenges in both capex and opex. The loudest argument against CEA is regarding its voracious appetite for electricity, which, if derived from non-renewable resources, can be a major environmental concern. The ecological footprint associated with the electricity required by a VF needs to be weighed against that of the long-distance transport of produce that VFs seek to significantly reduce by locating themselves close to the point of consumption of the produce. Some agricultural purists also denounce the practice of hydroponics itself as unnatural, claiming that crops should derive their nutrients from the earth and exist within traditional ecosystems, instead of deriving their nutrients from a powdered mineral solution dissolved in water.

Most VFs can be found today principally in the rich areas of northeastern Asia, North America, and parts of northern Europe. It is estimated that in 2017, there are less than 1.000 commercially-operating VFs in the world. With predictions of further plummeting lighting costs, and increasingly lower-cost kilowatt-hours of electricity from renewable sources, coupled with robust infusions of venture capital money, the industry seems poised to continue its ramp-up in key global markets in the short and medium term, and perhaps cause major disruption in the long term. This report takes a critical look at the economy and ecology of both our current critically flawed agro-industrial complex, and the hope of sustainable urban vertical farms, and the effects they might have on cities and regions in the years to come.