Assessing the Energy Demands of Indoor Vertical Farming

01 Our Partner

Who are they?

Pure Roots is a company established in 2018 that, in collaboration with the engineering team from Aerogrow, aims to build indoor vertical farms in urban communities across Canada [10]

Their Mission

Make a global impact on the nutrition and availability of local produce in the most sustainable way possible by addressing growing constraints with their vertical farms that would prevent the provision of **traceable**, **nutritious** and **high-quality** produce to urban communities [10]

02 The Issue: Community Food Security

A situation in which all community residents can obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes self-reliance and social justice [6]

Challenges of community food security that relates to traditional food production and distribution channels

Urban communities reliance on long distance transportation of "fresh produce", which has a high carbon footprint

03 Why it Matters?

- Address community food security issues by indoor vertical farming, which is a sustainable and energy efficient agricultural practice [2] [7]
- Working towards self-reliant communities, especially in the case of emergency (e.g. COVID-19) [7]
- On average, 11% of carbon emissions in conventional farming comes from transportation [9]

Our Objective

Provide Pure Roots with carbon footprint and energy usage calculation of their growing facility in Surrey so Pure Roots can have a better understanding of their energy consumption and become more efficient in the future [8].

04 Our Approach

DATA COLLECTION

- Vates and Scots Blue Curled kale growing specifications
- Power requirements based on Aeropod dimensions and specifications

LITERATURE RESEARCH

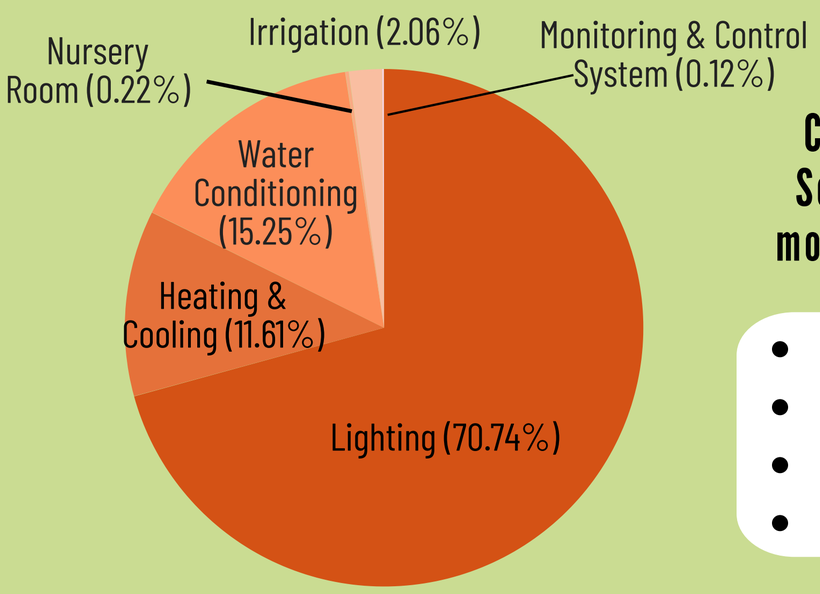
- Carbon footprint of conventional farming
- Alternatives to reduce costs and energy emissions

ENERGY CALCULATION

- Vates and Scots Blue Curled kale production for 6 months per Aeropod module
- Operating cost of Pure Roots Surrey facility

05 What We Found

Energy Breakdown of an Aeropod Module's Section



Costs of growing Vates and Scots Blue Curled Kale for 6 months in one Aeropod module

- Total energy: 118,772 kWh
- Total cost: $11,878.49
- Total Carbon Footprint: 1320 kg
- Yield: 7796 lbs

Carbon Footprint Comparison

Vates & Scots Blue Curled Kale

~0.374 kg CO^2/ kg Kale [5]

Vertical Aeroponic Farming

VS

Conventional Farming

~0.402 kg CO^2/ kg Kale [11]

Chinese Kale

06 Next Steps

Further research on Pure Roots' suggested alternatives to reduce their energy and carbon footprint and increase their operational efficiency

Feasibility of Solar

- Roof area: 302 m^2
- Investment cost: $297,500 CAD
- % of required energy can be met: 8.5%
- Time to break-even on initial investment: **80 years**
- Therefore adding solar panels is **not a feasible alternative** as BC Hydro rates are very low [4]

Evaluating Different Growing Mediums: Rockwool vs. Cocopeat

- **Rockwool**: Growing concern over the environmental impact (not biodegradable) [1]
- **Cocopeat:**
  - Reusable (3-4x) and biodegradable [3]
  - Reported to increase overall crop yield by 0.7% and sellable crop by 5.2% compared to **Rockwool** [3]

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