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### Integrated Climate Solutions: The Keene Energy and Agriculture Project (KEAP)

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## Integrated Climate Solutions: The Keene Energy and Agriculture Project (KEAP)

Six years ago, the municipal leaders of Keene, NH started a process that would lead to an innovative project and public-private partnership; The Keene Energy and Agriculture Project (KEAP). The project implements an Integrated Food and Energy System (IFES) facility, powered and heated by excess energy produced from the extracted methane from Keene's closed landfill. By repurposing the landfill's methane, the project is projected to reduce 7,000 metric tons of greenhouse gas emissions annually, while producing 500,000 pounds of produce and 66,0000 pounds of tilapia. This initiative will not only help Keene meet its climate action goals, but offers numerous social benefits and provides a model for others.

The city of Keene, New Hampshire has long been a leader for sustainable initiatives and was an early adopter of climate change and mitigation efforts. Keene was one of the first U.S. towns to have a Climate Adaptation Plan, including goals around developing better local food infrastructure. In 2009, city leaders realized they had an asset they weren't fully utilizing - their closed landfill. Inspired in part by a newspaper article about a closed-loop energy and agriculture system featuring a greenhouse, an aquaponics tank, and an algae tank in the nearby town of Brattleboro, Keene applied for and obtained a \$500,000 grant from the Environmental Protection Agency's Climate Showcase Communities Program to use its landfill for a similar climate and energy project. The City partnered with the Local Farms Project (LFP). KEAP was initially planned as a demonstration project; however, after exploring and

### HIGHLIGHTS

#### Projected Outcomes

- Greenhouse gas reductions
- Local produce and fish
- Increased food security and agricultural resilience
- Job creation & economic development
- Enhanced market access for local farmers
- Consumer access to healthy and highly certified food options

#### Barriers

- Local Skepticism
- Proof of Concept
- Resource Intensive

finding that the economics behind that model were break-even at best, KEAP was scaled up, doubling the size of the greenhouse to a full acre, resulting in a profitable modeled outcome.

None of the technological components within KEAP's IFES are new or particularly advanced, but the way that all of the components will be put together and used is innovative. Energy from the landfill methane gas will power and heat the greenhouse, the aquaculture and algae tanks, and distribution center. Waste from the tilapia fish will be used as nutrient rich organic fertilizer in the greenhouse. Water for the system will be collected during rainstorms through a roof catchment system and stored in a 55,000 gallon cistern. With the exception of an initial water delivery for the aquaculture tank, the IFES will be self-sufficient,

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which will keep operation costs low.

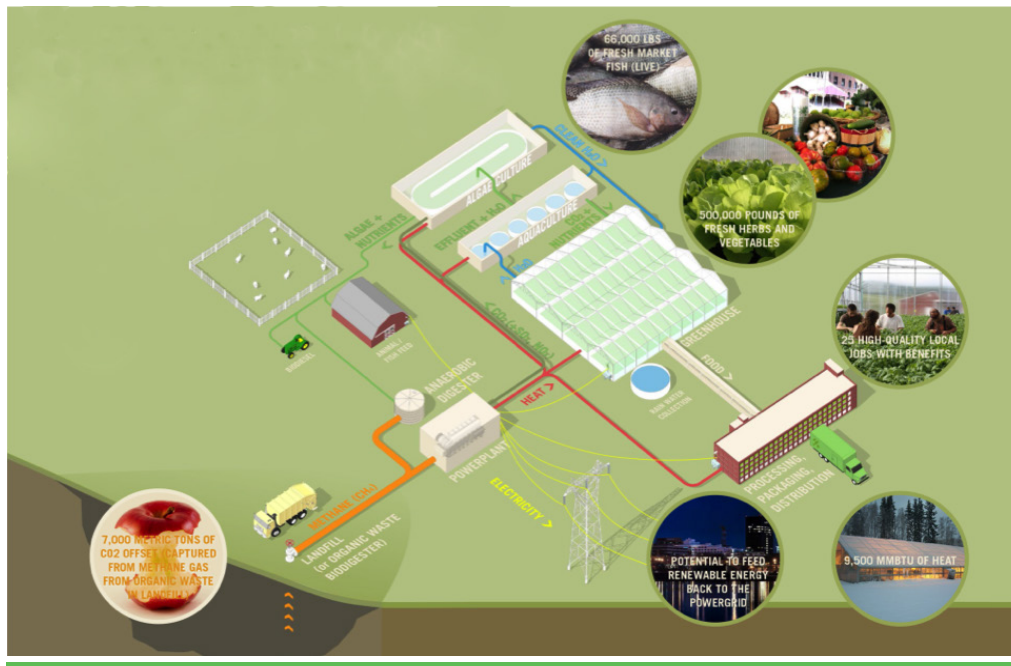
KEAP is much more than a conventional greenhouse project. KEAP plans to distribute the produce they grow through specialty and mainstream food retailers, such as Monadnock

Food Cooperative and Hannaford. In addition to KEAP's production and distribution, an innovative aspect of LFP's business model is their focus on supporting other local farmers access to the main food market. LFP's founder, Don McCormick, has created many partnerships with local farmers and has offered to aggregate and distribute their produce through the same channels as KEAP's produce.



**It is a triple win: local farmers gain market access, consumers gain access to reasonably priced local food, and KEAP achieves its goals and mission.**

KEAP faced significant adversity throughout its journey. A number of Keene citizens were apprehensive about the project and pushed back. They were concerned about funding sources, whether KEAP was an appropriate use of government resources, and if there was enough methane in the landfill to power both the materials recovery facility and KEAP. People also questioned the credibility of LFP. In response, Keene's municipal leaders put in countless hours to create a strong and reliable partnership and development agreement with LFP. LFP paid for a landfill methane inventory as well as for extraction and consumption models to be run in order to prove whether or not the landfill could produce enough gas to power both the materials recovery facility and KEAP for many



**FIGURE 1:** Keene Energy and Agriculture Project, Project Components: 1 acre greenhouse, aquaculture and algae tanks, and a processing, packaging, and distribution center.

years to come. It was estimated that the landfill would produce a sufficient amount of methane to power both facilities for at least 10 years.

Since KEAP is the first of its kind, the city wasn't sure which permits would be applicable. Therefore,

the city requested that LFP apply for multiple local and national level permits. This was a significant time, cost, and resource intensive process, and required LFP to obtain similar and overlapping permits. For example, under the National Environmental Policy Act LFP obtained a permit from the U.S. Environmental Protection Agency, as well as permits from the U.S. Department of Housing and Urban Development, and the U.S. Department of Agriculture. The process of getting KEAP off of the ground has been exceptionally lengthy and costly. After more than six years, KEAP is in the final stages of planning and construction. LFP cleared trees from the site in August (2015), and the construction of the greenhouse, aquaculture and algae tanks, and distribution center will begin in spring 2016.

**“It [the Keene Energy and Agriculture Project]... will reduce the effects of climate change as well as react[s] to the effects of climate.”**

**- Don McCormick, Founder of the Local Farms Project**

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## LESSONS LEARNED

### Linking multiple issues through a single solution

Local municipal leaders and officials wanted a project that was first and foremost about using the wasted energy they have at the landfill. The LFP went further by addressing many agricultural issues: water depletion due to high demand and excessive use, nutrient poor soils due to nutrient depletion, as well as the greenhouse gas footprint from shipping produce thousands of miles.

### Economically & environmentally viable business models are achievable

The city of Keene won't implement a project unless it meets three requirements: it is consistent with the city's goals, it is consistent with the city's budget, and it has a good economic argument. Rhett Lamb, the city's Planning Director stated, "Any argument we [city leaders] make needs to be economic." KEAP's business model is appealing financially due to the advantages of free or low-cost heat and power, and low input costs, and resilient through the project's ability to adapt to the effects of climate change. It is also strategic and economically smart. KEAP aligns with Keene's climate action goals and it addresses New Hampshire's increasing demand for local food.

**"The perception that things that are environmentally intelligent aren't economically viable is not correct."**

- Duncan Watson, Assistant Public Works Director, City of Keene

### Commitment to collaboration is vital

KEAP went beyond the traditional public-private partnership with a robust level of collaboration. The innovative business model and blended technologies meant that both the city and LFP had to be willing and able to invest a great deal of time on "due diligence," relationship-building, permitting, and creating a roadmap. Their mutual commitment, persistence, and belief in the project has given KEAP the needed "backing." Rather than stopping the project when it faced skepticism from local citizens, the team listened to critiques and responded with

due diligence. KEAP had a lengthy planning process, but it was well worth the time to build a strong and trusting relationship between city leaders and members of LFP.

In addition to the relationships Don McCormick built with local farmers, he has connected with several grocery store chains, food co-ops, colleges, hospitals, and other institutions within a 50-mile radius of KEAP for produce distribution. KEAP plans to work with local universities on algae and bio-diesel research. These partnerships are vital aspects of the project.

### Community development and climate solutions go hand in hand

KEAP creates 25 quality jobs with living wages and benefits. Along with job creation, LFP's vision for more local food in mainstream markets by implementing the protocols required for produce, from both KEAP and local farms, to enter the food market is expanding market capacity, access, and growth. Don McCormick stated "We will take farmers' produce and manage it and get it to market in a way that no farmer can do individually."

### Context is critical

Keene's track record as a climate adaptation leader and the town's commitment to achieving its climate action goals, laid the foundation for KEAP. Working with a progressive and action-oriented town that prioritizes climate adaptation and environmental efforts was vital for the success of KEAP. A climate champion is needed, at least for the first few examples of cutting edge solutions to climate change, such as KEAP. Once a success story is in place, a climate champion is not as pivotal.

### It's important to be proactive and anticipatory

The city of Keene and LFP are already planning for the amount of methane within the landfill to depreciate over time. The plan is to start a capital reserve fund for a replacement energy source in 10 years. Their long term goal is to integrate solar and/or anaerobic digestion into the IFES to power all of the facilities at the landfill.

### Better permitting processes and systems are needed

The redundancy of federal, state, and local

**“KEAP offers a valuable opportunity to present the issues of our changing world and potential and emerging solutions to students and practitioners as they observe an operating system approach to managing resources and waste through integrated design.”**

- Don McCormick Founder of the Local Farms Project

## FUNDING AND FUNDERS

- Project's Budget: \$3.4 million
- EPA Climate Showcase Communities Program Grant \$500,000
- City's Solid Waste Fund \$250,000
- Private Funding: \$1 million
- Monadnock Economic Development Corporation Community Development Block Grant: \$475,000

permitting processes was a burden in terms of cost, time, and human resources. One way to address this barrier for future projects is to examine whether one or two permits could act as proxy for other permits. LFP, the City of Keene, or another interested organization could also produce a document detailing their permitting process for KEAP

### Public-private partnerships need significant funding to get off the ground

The cost of developing a project like KEAP is high. To strengthen the security of the project, LFP partnered with numerous funding sources. Some financial support was from traditional public funding sources, while other funding came from sources more commonly used in the private sector. Thus Community Development Block Grants, EPA challenge grants, and other funding sources were crucial. As funders across New England look for opportunities to advance and accelerate integrated

climate solutions like KEAP, they might seek to deliberately channel funds to innovative public-private partnerships.

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## Integrated Climate Solutions Case Study Series

This briefing was researched and written by the Climate Solutions New England research team: **Sarah Large**, Jennifer Andrews, Cameron Wake, Catherine Ashcraft, Henry Herndon, Irene Queen, and Tom Kelly. This briefing is part of Climate Solutions New England's "Integrated Climate Solutions" project. The "Integrated Climate Solutions" project aims to promote leadership and innovation by highlighting initiatives that provide opportunities for enhanced civic participation and democratic governance, economic development, public health, and social justice, while tackling climate change mitigation and/or adaptation. Full case studies on each of the solutions featured are in development, and will be available at [climatesolutionsne.org](http://climatesolutionsne.org).