Massachusetts Farm Energy Program

Renewable Energy Tip

Compost Heat Recovery (CHR)

Compost Happens.
And with it, comes heat.

Composting is a common tool used by many farmers – whether livestock, vegetable, or forestry operations - in order to manage waste streams, improve soil fertility, and supply the market with valuable amendments. While composting happens passively on some farms, there is an **opportunity to capture the thermal energy of the composting process** to "fuel" farm-related activities, and cut the need for fossil fueled heating.

Historical precedent for using compost heat for farming operations has been found in ancient China and early 20th century France, and more recently in the 1980's in New Alchemy Institute's compost-heated greenhouses.

Current farm applications of Compost Heat Recovery (CHR) systems in the Northeast take a number of different forms: from extracting heat via water (hydronically) in coiled tubing embedded in Jean **Pain woodchip "mounds"**, to aerated **windrows** or **containerized** composting systems capturing heat from heated air and steam vapor with heat exchanger technology. Some systems are market-ready, such as Agrilab's Isobar heat transfer technology, and others are in the process of trialing and refinement for the particular feedstocks and heating needs presented by each farm setting. A heat capture rate of 1,000 BTU per hour per ton of active compost is the maximum expected from compost heat extraction processes in the Northeast, according to the Compost Power Network.

Is CHR a good fit for your farm?

Are you already composting? Or have the materials, infrastructure, and labor available?
If you are composting to meet waste management goals and managing the associated costs (labor, facilities, tools), **extracting heat can be an added bonus**. CHR requires a process of managing a complex combination of factors -- feedstocks (nitrogen balance and bulk density), moisture, oxygen levels and aeration, mechanics (turning, heat harvest), and temperatures -- to optimize quality compost output and thermal energy production.

Do you have a need for heat – currently supplied by fossil fuels - that matches your supply of feedstocks in volume and seasonality?
Whether you have a year-round supply of organic materials for composting (e.g. livestock operations) or primarily summer/fall (e.g. vegetable farms) -- the most effective use of CHR technology matches a consistent demand for heat with the seasonality of compost feedstocks. If you are using a CHR system to supply heat for critical on-farm needs, the more attentive you will be to managing the compost and CHR systems to maximize heat production. For farms that have a year-round supply of raw materials and use for heat - such as most dairy farms - the significant investment in composting infrastructure and CHR technology can be justified with energy savings.

Where is the technology at?
Late last year we made site visits with the Highfields Center for Composting in Vermont to several compost facilities working to establish and fine tune their heat harvesting processes. Many new CHR applications on farms are still in the exploratory stages in the Northeast, so partners are currently focused on testing systems, gathering data, and establishing benchmarks in order to establish design guidelines and recommendations for replication. One heat exchange technology, known as the Isobar ® heat exchange tubes, created by Agrilab Technologies, has been installed at four Northeastern dairies and is market-ready. Jasper Hill Farm, a 45-milker dairy and cheese-processing facility, composts using an aerated static pile with the goal of managing the waste (both from the dairy and liquid from the cheese-making process) they have to spread on limited acreage, and capturing thermal energy to heat custom-made anaerobic digesters. Auburn Star Farm's containerized compost/heat recovery unit captures the heat from composted manure from the 450-head dairy to supply heat to the farm's control room, at the replacement rate of $35 kerosene per yard of compost.

CHR Resources
For more information, check out this work done on Compost Heat Recovery:

Agrilab Technologies
City Soil
Compostpower.org
Cornell Small Farms Program
Highfields Center for Composting
New Alchemy Institute's Composting Greenhouse
On-Farm Composting Handbook