James B Houser, J Fundam Renewable Energy Appl 2017, 7:7 (Suppl)
DOI: 10.4172/2090-4541-C1-038

Cold climate anaerobic digestion

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Small-scale animal farmers face unique challenges in bringing products to local markets. To stay profitable amid changing market conditions, on-farm systems that integrate inputs and outputs to keep nutrient and energy flows within the farm are essential. Anaerobic digestion (AD) of wastes is a powerful technology that serves this function, as it transforms manure into two valuable on-farm byproducts: Renewable biogas that can replace fossil fuels and nutrient-rich digestate that can be used as an organic replacement of petrochemical fertilizers. However, small-scale digesters that function passively (and therefore cost-effectively) in cold climates previously did not exist. In the last decade, such digesters that passively maintain operating temperatures through the greenhouse effect and thermal mass have been developed and implemented for under $300 in material costs (Figure-1). These digesters have the potential for low-income farmers in cold climates to manage manure more efficiently while creating a yield-boosting organic fertilizer and a fossil fuel substitute that can be used for heating greenhouses, value-added process heating or electricity generation. As food systems become more localized and distributed, such a technology can be a keystone to small farm viability. Researchers at Appalachian State University in the mountains of North Carolina have been designing, constructing and testing multiple prototype systems for cold temperature anaerobic digestion. A solar thermal system that uses thermo-siphoning has proven to be effective in maintaining digester temperatures and gas production through Boone, North Carolina winters that have an average of Soil Loss and Available Water Content to Assess the Sustainability of temperature between 0 and 5°C. We also have a Taiwanese type digester that is buried, insulated and heated through heat exchangers in-line with a static compost pile that has been able to maintain proper temperatures during periods of cold weather. We are also experimenting with a super-insulated digester building that should require very little energy for temperature maintenance.

Biography

James B Houser is an Associate Professor in the Department of Sustainable Technology and the Built Environment at Appalachian State University, where he focuses on issues of resource management, biomass energy and the relationship of technology and society and recently co-authored a book entitled *Starting the Dialogue: Perspectives on Technology and Society*. He has been actively involved with issues of sustainability at Appalachian State University, serving as Faculty Co-Chair of the Sustainability Council. He has received BA in Biology from Wake Forest University, MA in Appropriate Technology from Appalachian State University and a PhD in Biological and Agricultural Engineering from Cornell University. His Post-doctorate work was at the University of Georgia in the Agricultural Water Use program. He was also a licensed Waste Water Treatment Plant Operator in the state of North Carolina.

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