

**White Paper**  
**ECONOMIC AND ENVIRONMENTAL BENEFITS OF ANAEROBIC DIGESTERS**  
 November 14<sup>th</sup>, 2017

According to the United Nations Food and Agriculture Organization (UNFAO), 30%-40% of all food manufactured in the United States ends up in landfills or incinerators as waste. Vanguard Renewables was formed to divert and process organic food waste and agricultural farm waste into renewable energy. The process for converting food waste to bio-gas is known as Anaerobic Digestion (AD). AD is commonplace in Europe, but relatively unknown in America. Food waste is collected from any generator and shipped to our farm digesters to be converted into renewable natural gas and organic fertilizer. AD has become an important renewable energy source as it is available to the grid as baseload 24/7 power. As importantly, because of the sequestration of Methane, which is a 25 times worse greenhouse gas than CO<sub>2</sub>, AD has a dramatically better GHG reduction profile than solar or wind per megawatt. Vanguard Renewables is a joint venture with institutional capital driven by the mission to rapidly expand farm-based anaerobic digestion throughout the Northeast. Anaerobic digesters have significant economic and environmental benefits for Massachusetts' ratepayers and taxpayers that are unmatched by other renewables. These benefits include improving the grid reliability, reducing greenhouse gases from our food system and supporting local family-owned farms.

**Anaerobic Digestion is Almost Ten Times Less Expensive Than Solar**

Solar, though now considered by many a mature industry, remains heavily subsidized by both state and federal incentives. Anaerobic digesters do not qualify for many of these programs, despite being a nascent industry with much more compelling economic and environmental benefits.

As summarized below, solar projects qualify for Renewable Energy Credits under the Massachusetts SREC II program, where credits trade at over \$265/MWH. On the comparable market for anaerobic digesters, Massachusetts Class I, credits trade at less than \$28/MWH, one tenth of the value of SRECs. In addition, solar projects still receive federal Investment Tax Credits (ITC) for up to a 30% credit of the cost of installation. Similar tax credits for anaerobic digesters long since expired in 2016.

ENERGY SOURCE	COST TO RATEPAYERS/MWH
Anaerobic Digestion	\$28
Solar	\$265
Difference	\$237/MWH cheaper
Multiple	9.46X less expensive



### Benefits to Massachusetts Electric Grid

Intermittent electricity sources like solar burden utilities and ratepayers with costly hardware upgrades to distribution circuits to accommodate the variability of these sources. Anaerobic digesters are unique in providing a rurally-deployed baseload source of electricity that improves rather than degrades the reliability of the grid.

Solar production is limited by the availability of its feedstock, the sun, and therefore has a capacity factor of less than 25%. Utilities need to continue to pay for fossil fuel “peaker” plants or make vast investments in storage to serve their customers’ load whenever solar is offline. These costs are inevitably passed on to ratepayers.

In contrast, anaerobic digesters have an almost unlimited feedstock, food waste and manure, and therefore a capacity factor of over 92%, on par with nuclear power. Anaerobic digesters even qualify for the ISO-NE Forward Capacity Market (FCM), a program established to ensure that the New England power system will have sufficient base-load resources to meet future electricity demand.

### Benefits to Massachusetts Farmers

Massachusetts’ farmers face declining revenue due to falling milk prices, rising operating costs and increasingly stringent environmental regulations. Anaerobic digesters offer revenue growth, diversification and cost reduction to small, family-owned farms struggling under global economic pressures. These projects provide reduced cost electricity and heat, as well as nutrient-rich fertilizer to replace odorous raw manure and synthetic fertilizers previously spread by farmers.

### Greenhouse Gas Emissions Avoided

Like other renewable energy technologies, farm-based anaerobic digesters replace fossil fuel derived electricity to reduce the carbon intensity of the electric system.

Unlike other renewables, farm-based anaerobic digesters provide significant ancillary environmental benefits for Massachusetts, including to:

1. Create a beneficial home for food waste that would otherwise go to landfills, helping fulfill Massachusetts’ ambitious goal to divert 350,000 tons per year of food waste by 2020.
2. Reduce methane emissions from manure storage and landfills, a 21 times more potent greenhouse gas than carbon dioxide.
3. Replace use of chemical fertilizers and heating oil derived from fossil fuels.

Considering these ancillary benefits (as illustrated in Table 1), one 1 MW anaerobic digester can reduce emissions by 25,000 tons per year of CO<sub>2</sub>, equivalent to the



energy usage of over 2,400 homes. You would need to build as much as 10 MW of solar to achieve the same reduction.

**TABLE 1: Greenhouse Gas Emissions Avoided by 1 MW Farm-based Anaerobic Digester**

Units produced or consumed (per year)			CO <sub>2</sub> avoided per unit (lb)	Total CO <sub>2</sub> avoided (tons)
Manure	9,125	tons	1,379	6,294
Food waste	36,500	tons	366	6,677
Electricity	7,972	MWH	1,889	7,531
Heating oil	263,368	gals	22.4	2,950
Fertilizer	148,000	lb	20	1,514
Total tons CO <sub>2</sub> avoided				24,966
Total CO <sub>2</sub> in home energy usage avoided				2,447
Total CO <sub>2</sub> in passenger vehicles avoided				4,801

