

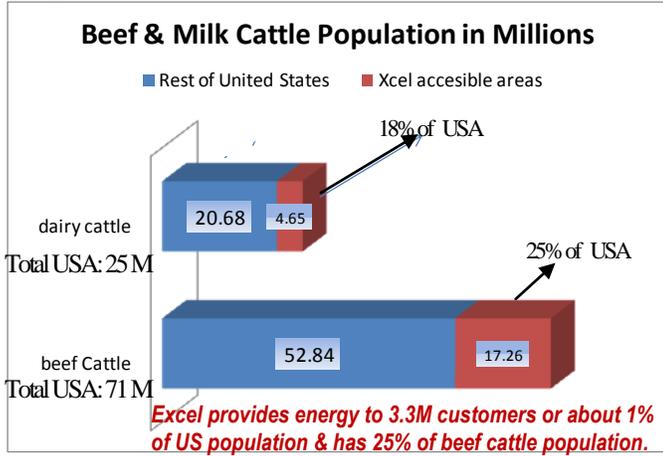


EXECUTIVE SUMMARY

Sizing the Renewable Energy Potential from cattle manure and bio-waste: a Two Billion \$ Opportunity

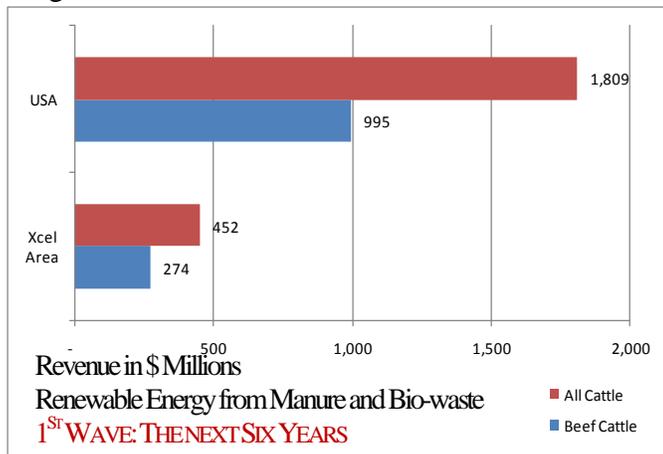
A more detailed report is provided from page 4 onwards to back up the statements made in Executive Summary

Fig 1



The total U.S. cattle population in 2007 as per NASS in January 2008 census was 96 million. Beef cattle was estimated at about 71 million and dairy cattle was estimated at about 25 million. In the areas accessible to Xcel within the eight States Xcel provides service, the beef and dairy cattle population is estimated to be 17.3 and 4.65 million heads respectively. While beef cattle generate an average of 7.6 lbs of manure on dry weight basis, dairy cows who have calved generate as much as 16.7 lbs of manure on a dry basis. Cattle manure energy content averages about 6,700 Btu per dry lb and many farmers all over the world have been extracting biogas energy through crude forms of anaerobic digesters for decades. With the recent trends of steep increases in energy prices, a few companies have started offering centralized manure based renewable energy systems focusing only on dairy farms.

Fig 2



However, Fig 1 clearly shows beef cattle population far exceeds dairy cattle population. Even after considering manure produced per dairy cattle is higher and only about 40% of beef cattle manure can be procured for centralized manure based renewable energy systems compared to 60% of dairy based cattle, renewable energy revenue from beef cattle farm based manure can be very significant as Fig 2 shows. *Heartland Renewable Energy (HRE) proposes to use a patented plugflow anaerobic digester energy recovery system that can handle manure from beef cattle farms.* In the 1st Wave of centralized plants, large cattle farms close to methane gas pipelines are primary targets, which is considered to be about 20% of the collectible cattle manure population. The feedmix for these plants are assumed to be 70% manure and 30% biowaste. The biogas generated is scrubbed to yield pipeline quality methane.

Fig 3

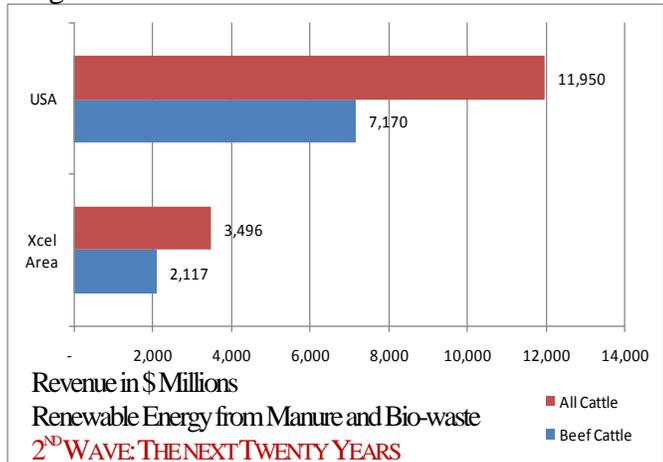


Fig 2 shows in Xcel accessible service areas alone beef cattle based renewable energy plants can potentially generate \$274 Million revenue in the 1st Wave, about 60% of all cattle (Beef and Dairy) revenue of \$452 Million. Methane gas prices are assumed to be \$9.50/MMBtu for this revenue generation. The 2nd Wave assumes 75% of all collectible manure can be utilized in the renewable energy plants and gas prices will double by 2020. Fig 3 shows in Xcel accessible service areas alone beef cattle based renewable energy plants can potentially generate \$2.1 Billion and all cattle based plants revenue goes up to \$3.5B. Twenty years from now, nationwide manure based renewable energy can touch \$12B, of which beef cattle based renewable energy revenue accounts for \$7B. Carbon Credits may make up \$1.3B of this revenue.

HRE with the help of VSNI can enable Xcel corner a significant share of this renewable energy market.