Gladfelter Engineering Group

Ecoremedy® Digestate Drying System
Commissioning Report

for

Enginuity Energy, LLC

Sold to

Hampton Alternative Energy Products

Located on

Hampton Feedlot,
23551 Highway 11
Triplett, Missouri 65286

System Reviewed by
Gladfelter Engineering Group
Greg Gladfelter, PE

October 14, 2013

Executive Summary:

Gladfelter Engineering Group is a boutique engineering firm specializing in distributed energy and tri-generation facilities. Our principal place of business is 3710 Robinson Pike, Grandview, MO 64030.

Mr. Greg Gladfelter, Principal of Gladfelter Engineering Group and Missouri state licensed professional engineer, witnessed the commissioning of Hampton Alternative Energy Products' (HAEP) Ecoremedy® Digestate Drying Facility on October 3, 2013 and authored this report.

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Purpose:

As part of a contract requirement, Enginuity Energy must have a professional engineer licensed in the state of Missouri review the commissioning of the Digestate Drying Facility and certify the plant has met the stated intention and performance guarantees.

Successful commissioning occurs when the drying system achieves a NET drying rate (material used for fuel not included) of 10 tons per week of 35%MC, or lower, based on an input of 1,400 lbs/hr of "wet" material at 67%MC, or lower, ("Qualified Solids") to the dryer.

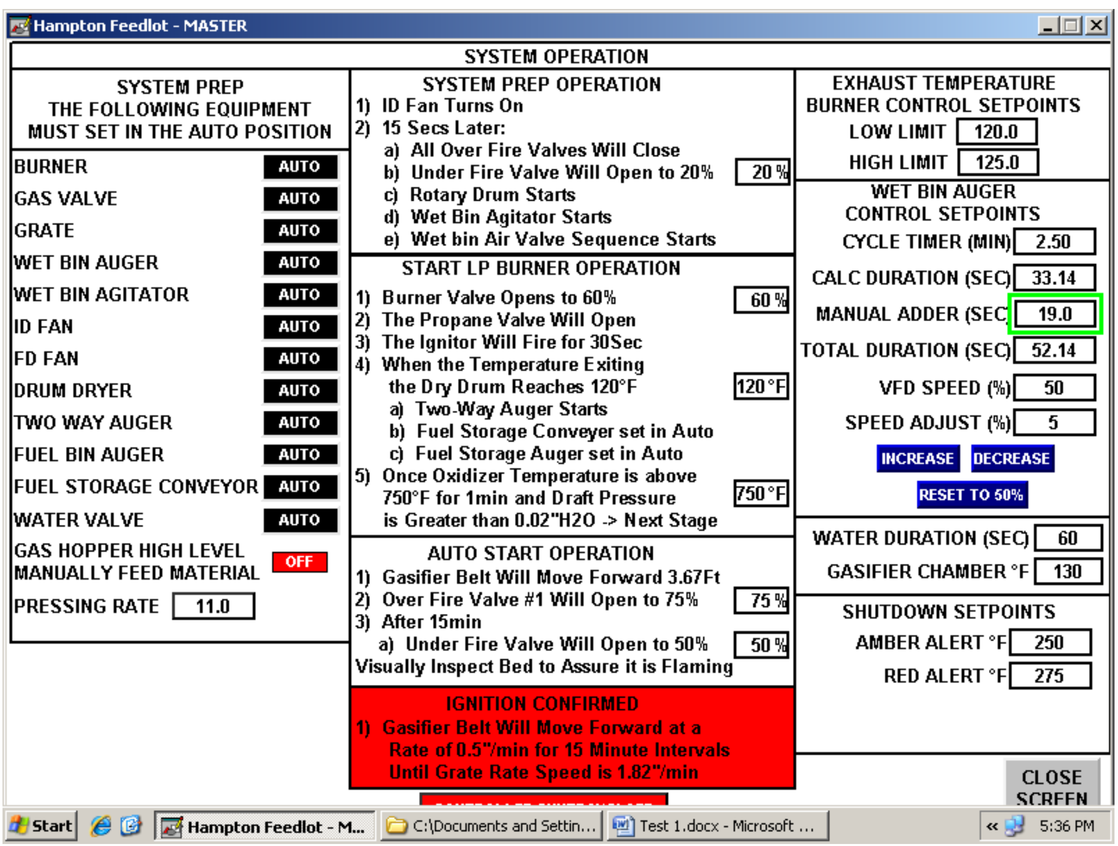
Finding:

I have monitored the test protocol and analyzed the subsequent data. It is my opinion the commissioning which occurred from October 1st to October 4th, 2013 has proven the system operates according to the intention of the design.

Key Observations:

The following key observations confirm successful commissioning of the Ecoremedy® drying facility.

1. The screen shot below clearly indicates the system achieved the design dryer throughput of 1,400 lbs/hr which correlates to 16.8 tons per day of Qualified Solids input to the dryer.



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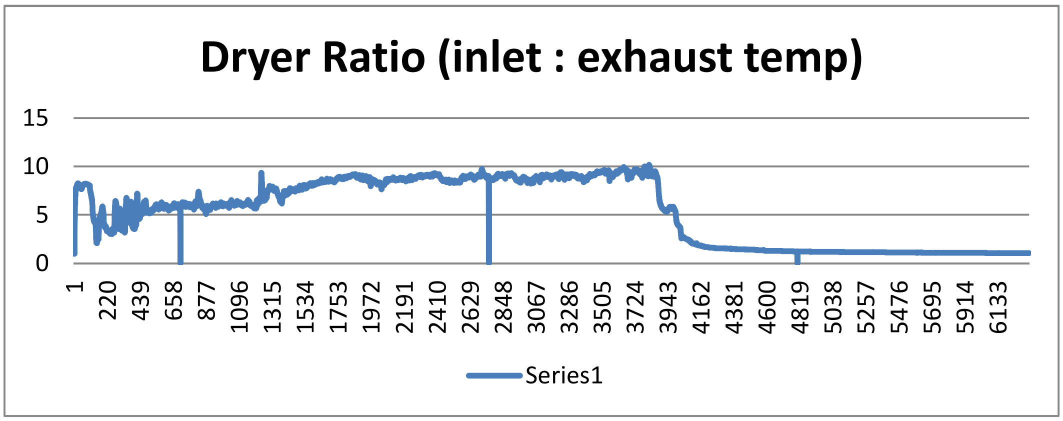
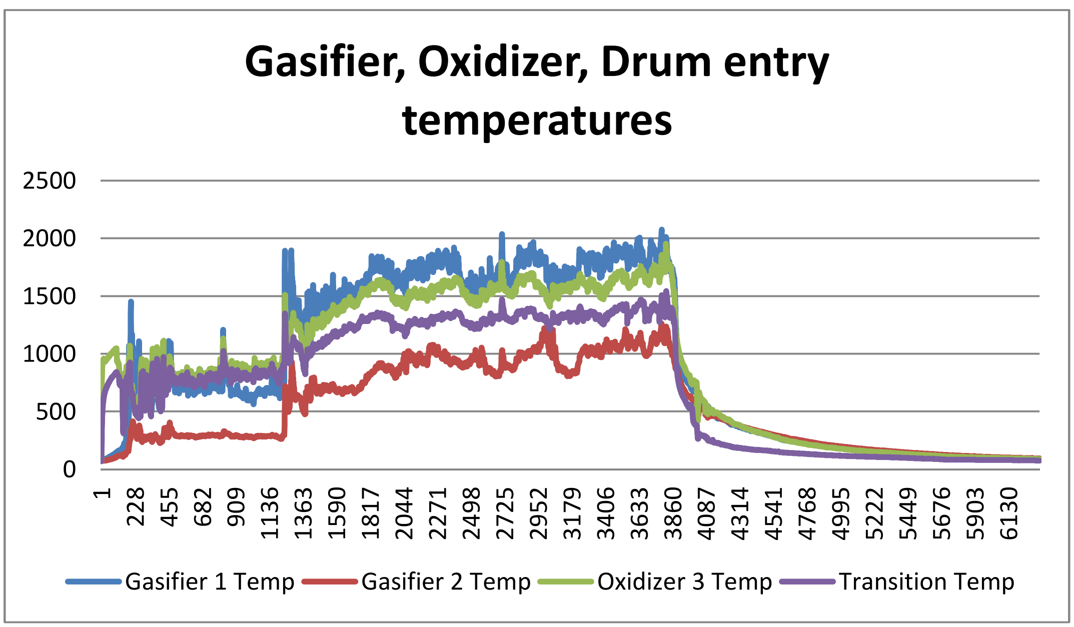
The Press Rate of 11 tons per day (TPD) corresponds to a dryer inlet feed rate of 33.14 seconds. The manual adder of 19 seconds is an increase of 57.33% (19 seconds ÷ 33.14 seconds) making the actual dryer feed rate equal to 17.31 tons per day (11 TPD x 1.5733) or 1,442 lbs/hr.

When analyzing the operational data, we learn that a dryer inlet to exhaust temperature ratio of 9:1 when operating at a Press Rate of 11 TPD is a good indicator for producing the 35% MC dried fiber. The amount of energy released during drying is a relationship between flue gas flow rate (corresponds to Press Rate) and the temperature drop from the inlet to the exhaust of the dryer.



The data clearly shows the system ran very stable at drier drum inlet temperatures of 1300F.



2. Key observation #1 confirms the input rate to the dryer exceeded the design rate of 1,400 lbs/hr. It is interesting to note the dryer output of finished dried fiber product is significantly improved over the target of 10 tons per week. The measured product production rates as noted on pages 17, 18, and 19 of the commissioning notes (Appendix A), well exceed the guaranteed hourly rate of 119 lbs/hr (10 TPW) with production at levels nearly doubling the guaranteed level. Achieved drying rates were 221.5 lbs/hr, 227.5 lbs/hr 200 lbs/hr and 145 lbs/hr respectively. The 145 lbs/hr was much dryer material which explains the lower weight per bag. To achieve this throughput, operators supplemented the press with stored pressed “wet” digestate.

   Only day shift operators weighed each bag of product but the night shift operators produced the same number of bags during their shift as did the day shift crew thereby confirming the same drying rate around the clock.

3. The Proximate analysis from Geochemical Testing lab (Appendix B) confirms the on-site moisture tests of the “wet” material conducted prior to beginning the commissioning with the “wet” material entering the system being 65% MC by weight.

Interesting Observations:

In this section of the report I offer some observations that are not a part of the commissioning review but interesting to note.

1. The system appears to run in a steady state with little operator involvement. That said, I am impressed by the control of the system. The operator’s ability to change the final “dried” fiber characteristics by manipulating the feed rate of “wet” digestate to the dryer is a simple control feature that works very well.

2. A water vapor plume is all that is seen emitting the stack. It appears to be free from particulate with little to no detectable odor emitted from the plant.

3. Enginuity Energy added an open drain to the ID fan housing. This addition made a significant impact to the draft on the system. The graphed data (Appendix C) clearly illustrates the installation of the open drain on the ID fan housing decreased the noise of the recorded draft curve. Before the drain was installed, the system tracked between 0.045”w.c. to 0.08”w.c. After the drain installation, the system draft was significantly more stable with draft pressure range of less than 0.01”w.c.

4. Enginuity Energy requested I comment on the use of compressed air in the filter. It is standard practice in the fabric filtration industry to use compressed air as a back pulse to purge filter media of entrained particles. The flue gas stream exiting the dryer contains more than 25% water vapor. The mass flow rate of the dryer system is orders of magnitude greater than the compressed air pulses. The use of an air knife with the rotary drum filter poses no performance or safety concern.