Modern Landfill Data Integrator Notes

Modern Landfill has seven 800 kW engines running on Landfill Gas. Heat is recovered from the engines using both jacket water and an exhaust heat exchanger. The recovered heat is then used to provide heating to a 7-acre greenhouse.

Data Point Details

The data at this site is provided monthly in the form of two Microsoft Excel spreadsheets. One file contains hourly interval data for the heat recovery temperatures while the second file contains daily interval data for engine power and gas use. All data in the hourly online database (except the Useful Heat Recovery) is created from daily data and is best viewed on either a daily or monthly interval. The details for each individual data point are outlined below.

DG/CHP Generator Output (total kWh)
The data for Generator Output comes from an accumulator of power exported. The column of origin for this data point is labeled "UTILITY METER" in the daily data files and has units of MWh. The difference between consecutive records is calculated for the energy use during the interval and converted to kWh. This interval energy data is then divided evenly into hourly data between the current and the previous record.

DG/CHP Generator Output Demand (peak kW)
The data for Generator Output Demand comes from daily data. The column of origin for this data point is labeled "OUTPUT" in the daily data files. The daily value is assigned to all hours between the current record and the previous day's record.

DG/CHP Generator Gas Input (cubic feet)
The data for Generator Gas Input comes from an accumulator of landfill gas use. The column of origin for this data point is labeled "LFG MCF" in the daily data files and has units of cubic feet. The difference between consecutive records is calculated for the gas use during the interval. This interval gas data is then divided evenly into hourly data between the current and the previous record

Total Facility Purchased Energy (total kWh)
The data for this channel comes from the difference between the Total Facility Energy and DG/CHP Generator Output channels.

Total Facility Purchased Demand (peak kW)
This data is the same as the Total Facility Purchased Energy for the hourly online database.

Other Facility Gas Use (cubic feet)
There is no data available for this point from the data files.

Total Facility Energy (total kWh) and Total Facility Demand (peak kW)
The data for Total Facility Energy comes from an accumulator of power used by the greenhouse. The column of origin for this data point is labeled "AUX METER" in the daily data files and has units of MWh. The difference between consecutive records is calculated for the energy use

during the interval and converted to kWh. This interval energy data is then divided evenly into hourly data between the current and the previous record. The Total Facility Demand Channel is the same as Total Facility Energy.

Unused Heat Recovery (total MBtu/h)
There is no data available for this point from the data files.

Useful Heat Recovery (total MBtu/h)
The Useful Heat Recovery comes from the water input and output temperatures for the heat exchanger and the flow rate. The columns of origin for this data point are labeled "Water Input Temperature", "Water Output Temperature" and "Galons per minute" in the hourly data files. The difference between the temperatures (converted to Fahrenheit from Celsius) is multiplied by the volumetric flow rate to calculate energy. The density and specific heat of pure water are used in the calculation.

Status/Runtime of DG/CHP Generator (hrs)
The generators are defined as being fully on for an interval if the generator output is greater than 4000 kW for the period (the fully-loaded capacity is 5600 kW). The status is given a value of 1 if the generator output is above 4000 kW and the generator output is divided by 4000 kW if it is below. These hourly values are included in the online database.

Ambient Temperature (avg °F)
The Ambient Temperature comes from daily data provided free of charge by the National Climatic Data Center (NCDC). The average temperature for a given day is assigned to all 24 hours in the day for the online database.

Total CHP Efficiency (%)
The Total CHP Efficiency is calculated from the online hourly database as the sum of the Useful Heat Recovery and the DG/CHP Generator Output, converted from kWh to MBtus, divided by the DG/CHP Generator Gas Input. The gas input is converted to MBtus using the Lower Heating Value (LHV) of the fuel which is 0.450 MBtu/cubic foot (Landfill Gas).

Electrical Efficiency (%)
The Electrical Efficiency is calculated from the online hourly database as the DG/CHP Generator Output, converted from kWh to MBtus, divided by the DG/CHP Generator Gas Input. The gas input is converted to MBtus using the Lower Heating Value (LHV) of the fuel which is 0.450 MBtu/cubic foot (Landfill Gas).

Data Quality Checks

The Data Quality Checks consist of three levels of verification: does the data exist, does the data pass reasonable range checking and does the data pass relational checks. The methodology for applying the data quality begins by creating a contiguous database. This is necessary to maintain compatibility between the many sites on the server. Next, the data received for this site is fit into the database, in this case we are using 15-minute data. For any period where there is data, the

data quality level is set to 3 for "Passes Relational Checks". We then work backwards to identify data that does not meet Relational and/or Range Checking.

The next step is to apply the relational checks. Relational checks attempt to identify data which is uncorroborated by the rest of the data set. For instance, data received indicating a DG/CHP Generator output when the gas use is zero is suspect. For data failing a relational check, the data quality level is set to 2 for "Data Passes Range Checks" or 1 for "Data Exists".

The last step is evaluating the range checks. The range checks consist of reasonable high and low values based on facility and DG/CHP Generator information. Data that falls outside the defined range for the database value has its data quality level set to 1 for "Data Exists."

It is necessary to work backwards when applying data quality checks to insure that data gets set to the lowest applicable data quality level. It is possible for data to pass the relational check and fail the range check and such data will be set to a data quality level of 1 for "Data Exists."

Table 1. Data Quality Definitions

Data Quality Levels	Description	Definition
3	Passes Relational Checking	This data passes Range Checks and Relational Checks. This is the highest quality data in the data set.
2	Passes Range Checks	This data passes the Range Checks but is uncorroborated by Relational Checks with other values.
1	Data Exists	This data does not pass Range Checks. This data is found to be suspect based on the facility and/or CHP equipment sizing.
0	Data Does Not Exist	This data is a placeholder for maintaining a contiguous database only.

Details on the Range and Relational Checks are found below.

Relational Checks

These are no relational checks at this site due to only having daily data available (except for Useful Heat Recovery).

Range Checks

These checks are applied after the data is converted to hourly data. If the value fails the range checks, the data quality levels is set to "Data Exists"

Table 2. Range Checks for Modern Landfill

Data Point	Upper Range Check	Lower Range Check
DG/CHP Generator Output	5700 kWh	0 kWh
DG/CHP Generator Output Demand	5700 kW	0 kW
DG/CHP Generator Gas Use	150,000 cubic feet	0 cubic feet
Total Facility Purchased Energy	400 kWh	0 kWh
Total Facility Purchased Demand	400 kW	0 kW
Other Facility Gas Use	N/A	N/A
Unused Heat Recovery	N/A	N/A
Useful Heat Recovery	50,000 MBtu	0 MBtu
Status/Runtime of DG/CHP Generator	1 hrs	0 hrs
Ambient Temperature	130°F	-30°F

Notes: Data failing the Range Check has the data quality level set to 1 for "Data Exists"

ASERTTI Protocol Adherence

This site does not adhere to the ASERTTI Long-Term Monitoring Protocol. Most of the required performance parameters are being collected. Data for thermal energy recovered is provided in hourly intervals. It is not known whether this hourly data are samples or averages over the interval. All other data (power generated and gas use) is recorded on a daily interval. The measured Lower Heating Value of the fuel (Landfill gas) is not available.

Monitoring Notes

July 5, 2005

We received an hourly data file for the month of May 2005 and a daily data file spanning from January - May 2005.

July 25, 2005

We received an hourly data file for the month of June 2005 and a daily data file spanning from January - June 2005.