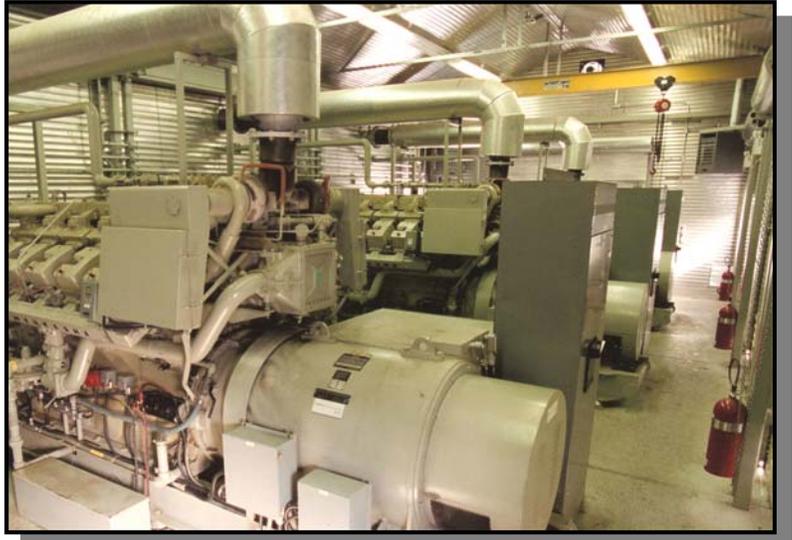


Waste Gas Processing

AHP personnel have designed, overseen construction and operated waste gas recovery and processing systems including both landfill gas and biogas facilities. Most of these facilities use the processed gas as an energy source for generating steam and electricity.

Over 120 active landfill gas extraction systems were designed.. Well depths ranged from 20 to 275 feet with diameters from 24 to 48 inches. These projects included:

- ❖ Modeling the landfill for gas production timing and rates.
- ❖ Locating and sizing the vertical wells, sub-lateral, lateral, secondary and primary flow lines.
- ❖ Locating and sizing water removal facilities and filters.
- ❖ Sizing and specifying blowers and flares.
- ❖ Designing electrical service.
- ❖ Designing buildings for blowers and control systems.
- ❖ Designing and operation of steam and electrical power generating plants using the waste gas as fuel.



Processes and patents in this field include a patent on leachate disposal. In this process the landfill gas is used to boil the leachate, then injects the steam produced into an enclosed flare for incineration and disposal. Enclosed flares with dual combustion and steam injection zones were also developed resulting in improved combustion efficiency and lowered emissions.

Waste biogas processing systems were designed where the gas is used as a fuel to produce steam, electricity and drive other rotating equipment. Projects ranged from a single 80 kW unit up to multiple 5 mW and 20 mW units producing 35 mW in total. These projects included:

- ❖ Over 130 mW of electric power generation using biogas as fuel.
- ❖ Internal combustion engines driving both generators and compressors..
- ❖ Gas turbines.
- ❖ Steam turbines using heat recovery from biogas fired gas turbines.
- ❖ Steam turbines using steam generated in biogas fired boilers.

AHP personnel have operated biogas processing plants that remove water and carbon dioxide from the gas and produce pipeline quality high BTU gas. Other plants were designed and constructed that process wet biogas into burner quality dry biogas for use in gas-fired commercial equipment. In all, projects were developed in 40 of the lower 48 states along with several in Canada and Europe. In all cases these projects required construction and operating permits which included stringent control on emissions and liquid discharges. Safety programs were developed in English, Spanish and French for field personnel.



Representative projects include:

Michigan

An active landfill gas extraction system comprised of approximately 150 extraction wells and more than 5 miles of horizontal piping, gas compression, gas dehydration, electric switchgear, controls, monitoring and seven 1500 Hp internal combustion engines, each driving a 1000 kW electric generator.

Illinois

An active landfill gas collection system, 1000 hp electric drive gas compressors and 1500 horsepower standby IC engine drive gas compressors, gas dehydration, 5 gas fired turbines driving 5 MW generators, exhaust heat recovery for steam production with additional duct burners, and one 5 MW steam turbine/generator set. The total plant was designed to originally produce 30 MW with spare space to add an additional 10 MW of gas fired turbine/generator capacity.

Tennessee

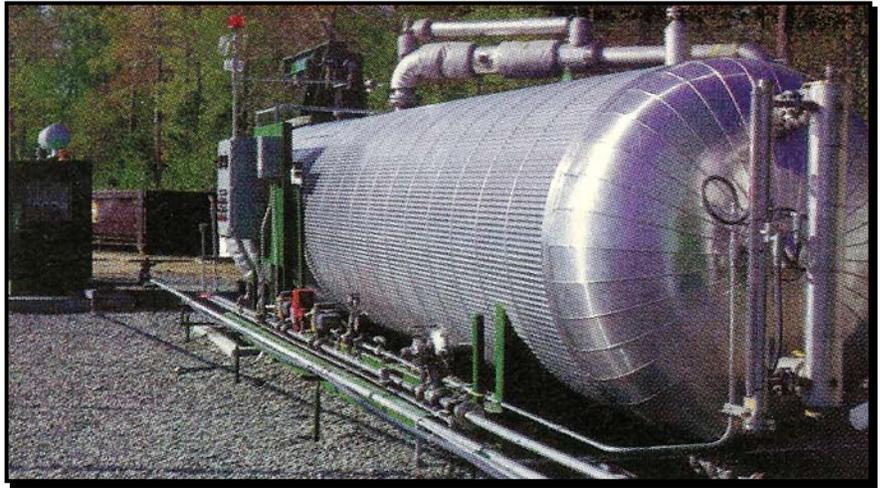
An active landfill gas extraction system, gas compression, leachate collection and incineration, and electrical generation of a 265 kW induction generator powered with an IC engine using landfill gas as fuel. The power generated was in parallel with the utility, displaced site power consumption and delivered excess electricity to the utility for sale at a negotiated rate.

Minnesota

An installation of a 525kW engine/induction generator complete with fuel processing and compression equipment for the purpose of diverting landfill gas from flaring to a beneficial use. This project provided enough electrical power to sell to the local distribution utility and offset the total site electrical use. This project won a USEPA-LMOP award as an outstanding project the year it was developed.

Massachusetts

An active landfill gas extraction system comprised of approximately 70 extraction wells and more than 3 miles of horizontal piping, standby enclosed flare, gas compression, gas dehydration, electric switchgear, controls, monitoring and three 1500 Hp internal combustion engines, each driving a 1000 kW electric generator. This 3 MW project was the first landfill gas to electric energy project developed in the state of Massachusetts. The location was surrounded by residential development and met stringent emission and noise requirements.



Mississippi

An active landfill gas extraction system, standby enclosed flare, compression, liquids control and a 4 mile delivery pipeline to the customer. Landfill gas supplemented purchased natural gas in a clay drying application. Landfill gas was the primary fuel, and as heat demand exceeded supply, purchase gas was blended to meet the load.

California

An active landfill gas extraction system, dual combustion zone enclosed flare and landfill leachate incineration with permits obtained from the BAAQMD for operation. The emissions from the flare not only met the strictest allowable standards, but were below the permit limits.