5. Landfill Gas Contracts and Regulations

Landfill owners and operators establish contractual arrangements with end users for the sale of LFG, electricity and other environmental attributes generated by an LFG energy project. The agreements establish the project's value and are critical to its long-term success. These agreements are especially essential for projects that rely on financing. Lenders and investors are particularly interested in the structure of contractual agreements and potential risks, which directly affect the terms of the financing. Therefore, landfill owner/operators and project developers should thoroughly evaluate the elements of all potential contractual agreements. This chapter discusses three categories of contracts: power sales agreements (PSAs) (for electricity generation projects), LFG purchase agreements, and environmental attribute agreements. An overview of applicable regulations and permits is also provided.

Most LFG energy projects are "must run," meaning that they operate continuously and electricity is not dispatched by a system operator. Operators of dispatchable LFG electricity projects can take advantage of price variations in the electricity market by bringing units online or taking units offline, in response to demand. Dispatchable LFG electricity projects are typically managed from a central location via remote connection to the facility's supervisory control and data acquisition (SCADA) systems.

5.1 Power Sales Agreements

Traditionally, electricity generated from an LFG energy project has been sold through a PPA to investor-owned utilities (IOUs) that provide electrical service in the region where the project is located. Since the late 1990s, non-regulated entities (such as independent power producers, co-operatives, municipalities, power marketers and power purchasers) have had greater access to the electricity grid, creating competitive electricity markets in many states and regions. With the advent of these competitive markets, electricity providers offer many more options for the purchase of electricity.

Landfill owners and project developers should consider these options carefully. Electricity and other attributes, including capacity, renewable attributes of the power and ancillary services, can be sold individually or as a "bundled" product. Furthermore, many of these electrical elements can be sold on either a daily basis or for a fixed term.

Power Purchase Agreement With an IOU. Historically, the most common structure has been to sell the electricity to an IOU, cooperative or municipal entity through a PPA. The electricity, including capacity, is sold to the IOU at a fixed price, with some measure of escalation or at an indexed price based on an estimate of short-run avoided cost or publicly available local market price mechanism. Environmental attributes related to the electricity generated by the LFG energy project may or may not be included in the PPA. Environmental attributes are associated with electricity produced by renewable energy sources and can be referred to as "green power." Executed PPAs can address the transaction of the electricity alone or might include some or all of the green power attributes. These agreements are typically negotiated or obtained through a competitive bidding process. The terms of these contracts can vary greatly, from 1 to 15 years. Entities providing financing are most comfortable with PPAs because of their predictable revenue stream. Financing entities prefer a PPA term equal to or longer than the term of the financing.

Power Sales Contract to a Power Marketer or Wholesale Buyer. Electricity generated by an LFG energy project can be sold to power marketers, wholesale buyers or other entities eligible to buy or sell electricity in states and regions with robust electricity markets where electricity pricing is transparent. The contract terms can vary widely; two common terms are:

- A fixed "bundled" rate that typically includes energy and capacity, and may include renewable attributes of power, for a fixed term of 2 to 15 years. The rate can be adjusted annually for inflation.
- A variable rate for electricity (energy or capacity) at a premium or discount (depending on market conditions) to a publicly available market price for a fixed term. Rates may include a floor and a ceiling price. Rates may adjust daily, monthly, quarterly, bi-annually or annually. The term can be fixed for a period of 1 to 10 years.

Examples

Examples of states/regions that have robust electricity markets and transparent pricing include:

- PJM Interconnection
- New York Independent System Operator
- California Independent System Operator

Selling Directly Into a Market. Project developers or owners can sell directly into electricity markets for the market price for energy and capacity. The price for energy is usually estimated theoretically a day ahead based on bids received, then updated in real time several times per hour (every 5 to 15 minutes) by the system operator. The market price is set by the lowest marginal cost of the next generating unit to be dispatched and provide power to the system. Capacity is typically bid and prices are established for longer time periods — typically 1 to 6 months, but this time varies. The renewable attributes of the power are not typically sold in these markets, but these markets may track and verify the production of these attributes.

Net Metering. As of July 2016, 44 states, Washington D.C., and five U.S. territories offered net metering.[1] Net metering allows consumers to offset their electrical use with appropriately sized renewable electric generation located on site. As a result, the total amount of electricity supplied to the site is reduced, yielding a lower "net" amount of electricity provided by the power company. The operator pays for this "net" amount of power supplied. In some cases, onsite generation may exceed onsite electricity needs. Net metering provisions have emerged to allow operators to sell excess electricity to the local power company and receive credit for the amount of electricity provided back to the electrical grid. The approach allows the LFG energy project to generate and use electricity on site while maintaining access to grid electricity and creates a source of revenue for the LFG energy project through the sale of excess electricity. States set their own net metering regulations and typically limit the capacity of the generation.

A summary map of net metering policies is available from the DSIRE website.

Other Consideration — Electric Grid Interconnection

In addition to contracting issues, LFG energy developers or owners must carefully consider the complexity, cost and timing of interconnecting to the electric grid. Grid interconnection can be the most important issue in evaluating the feasibility of a project. Factors that drive interconnection costs and timing include:

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[1] Database of State Incentives for Renewables & Efficiency (DSIRE). July 2016.

- Amount of electricity (MW) the developer wants to connect to the grid
- Size and capacity of surrounding distribution (12 to 15 kilovolt [kV]) and medium tension (20 to 69 kV) distribution lines
- Location of the distribution substation
- Interconnection procedures and regulations
- Utility requirements (such as communications, protection and control)

These factors are highly dependent on the project's location and the utility's experience and willingness to interconnect with LFG energy and other distributed generation projects. In some regions and states, regional transmission operators (RTOs) and regulators are trying to make the interconnection process for small renewable projects more streamlined, transparent and cost-effective. Early on in the project development cycle, the utility completes an interconnection feasibility study (paid for by the developer), which will define many of these issues. An interconnect agreement will be required with the utility, as well as agreements for the design and construction of the interconnection.

Costs and timing can vary substantially among projects, so LFG energy developers should begin the interconnection process as early as possible and engage interconnection experts with local experience.

5.2 LFG Purchase Agreements

LFG is typically sold for one of three purposes:

1. For use as a substitute for other fuels to create hot air, hot water or steam (for example, to fire boilers, kilns or furnaces). This type is typically referred to as a direct-use project or a medium-Btu project.
2. To power an LFG-fired electricity generation facility.
3. For injection into a natural gas distribution or transmission pipeline, after purification to natural gas pipeline standards (typically referred to as a high-Btu project).

Direct-Use Sales of Medium-Btu LFG

Direct-use projects use three basic types of contracts: fixed price, indexed price and a fixed/indexed hybrid approach. These contracts are usually set on a Btu-delivered basis. Delivered LFG is commonly sold at a discount to natural gas prices as a result of the following factors:

Indexed pricing bases the cost of LFG on a discount of current natural gas prices.

- Requirements to transport LFG and modify equipment (such as boilers) to use LFG
- Potentially higher O&M costs because LFG has more impurities than natural gas
- Need for the end user to have backup fuels

The level of discount is determined by the level of investment required to construct and operate the project and by how these costs are distributed among the participating parties.

Fixed Price Contracts. A guaranteed fixed price contract establishes a fixed price for the gas for a certain length of time. This price usually escalates over time to account for inflation. The initial price for LFG is typically set at or below the average market price for natural gas and is based on costs to implement the LFG energy project and the return on investment required by the participating parties. Because of the volatility of natural gas prices, fixed price contracts for LFG are less common.

Indexed Sales Contracts. Indexed sales contracts use natural gas prices to determine the value of the LFG. Normally, the "city gate price" of natural gas is used, which is the price paid by the local natural gas utility and can vary by region. In some cases, price incentives result in discounts to a market price for natural gas. Discounts can vary significantly depending on such factors as local RPS targets, costs of transporting natural gas, the local utility's strategy for incorporating alternative fuels, the amount of investment required for a specific project, and the parties responsible for necessary investments.

When negotiating price with the end user, the owner of the LFG should consider that the end user may not have access to the natural gas wholesale pipeline pricing indicated in most commonly available indices (e.g., Henry Hub). Buyers must pay additional costs for transportation, infrastructure construction and distribution of the natural gas, which can result in prices that exceed the wholesale indices. Because of the volatility of natural gas prices, indexed LFG sales contracts are highly variable in terms of revenue; however, they can provide the end user with considerable savings.

> Natural gas prices have recently been low and indexed sales contracts may not be viable without additional incentives. For example, if biogas is being upgraded to be used as CNG for vehicle fuel, incentives are present to use LFG as a supplement to natural gas. Indexed sales contracts may be more attractive to LFG owners in the future if natural gas prices increase.

To limit price risks on both sides of the contract agreement, indexed contracts typically include provisions for maximum and minimum pricing (e.g., when the government puts a legal limit on how high the price of a product can be [ceiling] and when the government put a legal limit on how low a product can be [floor] prices). Setting a floor price limit is essential to reducing the risk to the seller of the LFG, particularly if the seller is making a significant investment. A financing entity typically requires setting a floor price to ensure that debt payments can be made in all market conditions. A price ceiling is essential if the LFG buyer is making a significant investment; it also provides an additional incentive to use LFG. Typically, if one party is requiring a floor price, the counterparty asks for a ceiling price, or vice versa.

Learn more about floor prices and ceiling prices.

Hybrid Contracts. LFG sales contracts have also been implemented in other creative ways to minimize risk and maximize economic benefits. One such option is a hybrid of the two previous types of contracts. In an example hybrid contract, a fixed price contract is implemented for a certain period of time (for example, until the capital investment is recovered) and then converted into an indexed price contract. Sales costs depend on the level of investment and equity participants.

LFG contracts may include a minimum guarantee on the quality and amount of LFG to be delivered and a minimum guarantee on the amount of gas that will be consumed (known as a "take or pay" clause). LFG energy project developers or owners should consider factors such as equipment and potential wellfield uncertainties when they agree to a minimum guarantee on gas delivery. In addition, landfills that are closed or closing in the near future should be cautious about setting aggressive gas quantity or quality limits. Conversely, the energy user should consider any routine plant shut-downs or other possible disruptions that would limit the need for gas when setting a minimum consumption guarantee.

LFG Sales to an Electrical Generation Project

These contracts are similar to those developed under a direct-use project application as discussed above. The contractual relationships between the LFG energy project owner or operator (the electricity generator) and the purchaser of the electricity is provided in greater detail in Section 5.1.

High-Btu Sales

LFG that is purified to natural gas pipeline standards can be injected into a natural gas distribution or transmission line subject to state regulations. When it is sold into a regional distribution line, LFG is typically sold to the distribution company at an indexed price on a Btu basis. When LFG is sold into a natural gas transmission line that transports gas over long distances before it is distributed, a more complicated contract may be required with the gas transmission line company. Contracts with transmission line companies will address the provision of transmission services to the ultimate purchaser of the LFG and will also include contract provisions with the ultimate purchaser. The LFG may ultimately be sold to a natural gas supplier, marketer or distributor at a fixed price or at an indexed natural gas price appropriate for the location or point of delivery. The environmental attributes also could be included as part of this contract.

> To purify LFG to natural gas pipeline standards, the concentrations of carbon dioxide, oxygen, nitrogen and other impurities (such as volatile organic compounds, hazardous air pollutants, hydrogen sulfide and siloxanes) must be reduced. For more information about treating LFG to pipeline standards, see Chapter 3.

5.3 Environmental Attribute Agreements

An LFG energy project developer may sell a project's environmental attributes for additional revenue, or to provide more revenue to the landfill owner. Environmental attributes can be sold together or separately, depending on the market and the nature of the contract entered into by the landfill owner or LFG energy project owner. Broadly, there are two types of environmental attributes:

- Direct – destruction of methane (a potent GHG)
- Indirect – displacement of fossil fuel use by LFG use, a renewable energy resource

All contracting parties should ensure that ownership of the environmental attributes, including the rights to the GHG emission reductions, are clearly defined. Historically, agreements have been relatively clear about ownership of LFG rights; however, contract language has not been as clear with respect to evolving environmental markets and incentives such as renewable energy certificates, tax credits and GHG credits. A clear definition of which party owns each of the environmental attributes of the LFG is critical for new project agreements and amendments to older agreements.

> For information about renewable energy tax credits or other incentives to improve project financial feasibility, see Chapter 4.

GHG Credits Derived from the Destruction of Methane in LFG

The GHG reductions achieved by the destruction of methane in LFG have market value and can be sold in voluntary and compliance markets. Essentially, an entity that wants, or is required, to reduce its GHG emissions can indirectly fund LFG collection and control projects through the purchase of GHG emission reduction credits from landfills. These GHG credits are traded in units of metric tons of carbon dioxide equivalent. Currently, GHG credits are traded in either a compliance or voluntary market; no single market nor single standard for the trade of GHG credits currently exists.

For a landfill's project to qualify for a GHG emission credit, the destruction of LFG must be "additional," meaning that the LFG must be collected and controlled voluntarily and cannot be required under regulations such as EPA's NSPS for MSW landfills. Generally, a project does not qualify for GHG credits if the landfill is required to collect and control LFG under any local, state or federal regulations for control of emissions, odors or gas migration. Although buyers and markets vary, most require the LFG collection system to have been installed recently. Some buyers and markets will accept LFG collection systems that commenced operation as early as January 1, 1999.

Voluntary Markets. Most GHG transactions currently take place in a voluntary market, which is composed of sellers, buyers, brokers and aggregators who are voluntarily trading GHG credits with the goal of reducing the buyer's carbon footprint. Voluntary market transactions occur in several over-the-counter (OTC) markets.[2]

Participants in voluntary OTC markets, or firms investing in GHG credit projects, will sign agreements with landfill owners to obtain the right to the GHG credits and may provide the investment funds for the LFG collection system in some situations. The structure of these agreements is variable and will primarily depend on the level of equity, if any, provided by the party interested in procuring the GHG credits. Contract structures may provide ongoing revenue sharing or may allow the equity provider to recover their investment before revenue is shared with the landfill. This structure would apply for agreements where the GHG investment firm provides equity for all or part of a gas collection and control system. GHG agreements where equity is provided are typically longer-term agreements (up to 10 years) to minimize capital recovery risk by the investor. Simple GHG credit purchase agreements where significant equity is not provided can have a much wider range in the length of the agreement. These non-equity GHG purchase agreements may address the transaction of a discrete amount of previously generated GHG credits, or may provide a longer-term (or forward) agreement for the rights to future GHG credit generation.

A *standard* is the overall framework of a GHG program, whereas a *protocol* is a specific set of requirements that outline how GHG credits are developed for a specific project, such as an LFG energy project.

Voluntary GHG markets are established when an entity (or group) takes the initiative to offer one in light of a perceived unmet level of interest among potential buyers and sellers of GHG credits. The continued existence of a given voluntary market is a reflection of adequate levels of seller and buyer participation. These voluntary markets are typically independent of each other, and no one standardized methodology or protocol exists among these markets for determining eligibility of credits. These voluntary markets operate using several different standards and protocols for determining project eligibility and verifying the GHG credits. Carbon standards include the Verified Carbon Standard, the Gold Standard, the Climate Registry and the American Carbon Registry. Protocols outline project eligibility, monitoring, recordkeeping, quantification and reporting requirements. GHG methodologies applicable to landfill projects in the voluntary markets currently include:

- Climate Action Reserve Landfill Project Protocol Version 4.0
- Greenhouse Gas Protocol
- EPA Center for Corporate Climate Leadership

Once the methane destruction from the LFG energy project has been quantified using the selected protocol, it must be converted into metric tons of carbon dioxide equivalent for trading. To calculate this conversion, the amount of methane destroyed is multiplied by the global warming potential of methane, which can range from 21 to 28 depending on which GHG standard or protocol is used. Once a third party

[2] Ahead of the Curve: State of the Voluntary Carbon Markets 2015. Forest Trends' Ecosystem Marketplace. June 3, 2015. http://forest-trends.org/releases/p/ahead_of_the_curve_state_of_the_voluntary_carbon_markets_2015.

has verified the GHG credits, they may become verified emission reductions, carbon financial instruments or other protocol-defined instruments, depending on the market or the protocol used by the buyer.

The GHG credits generated by the voluntary collection and destruction of LFG at a landfill can be a significant revenue stream for the owner of the LFG rights, as described in Chapter 4.

Compliance Markets. Compliance markets are also being established in some states and regions of the United States. The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort by Northeastern and Mid-Atlantic states to reduce carbon dioxide emissions in the region. Participating states include Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont. RGGI states are proposing to regulate carbon dioxide emissions from power plants through a regional cap-and-trade system. RGGI has established its own emissions trading program and a specific methodology for landfills to provide GHG offsets to this market.

California enacted a bill (AB-32) in 2006 that required the Air Resources Board (ARB) to establish rules to reduce GHG emissions. The ARB implemented an enforceable cap-and-trade program in 2012.[3] The Western Climate Initiative — including California and Canadian provinces — developed ‘model rules’ to form the basis of a regional GHG reduction program, including a cap-and-trade system. As these and other mandatory GHG reduction programs mature, they might create additional opportunity for revenue streams from LFG energy projects, depending on whether they are designed to accommodate GHG offsets from landfills.

Renewable Energy Attributes of LFG Energy Projects

LFG energy project developers and owners have opportunities to sell the renewable energy attributes of an LFG electricity project through several potential markets. Transactions in these markets provide value based on the reduction in fossil fuel used to create energy when LFG energy projects are implemented.

RECs. Many states have or are adopting RPS. A state RPS requires an electrical supplier, provider or distributor who sells to retail customers (an “electric services provider”) to include a minimum percentage of electricity from renewable generation. Typically, the electric services provider can meet the minimum percentage by purchasing renewable generation attributes from anywhere within the state or regional electric control area. Many state RPS programs group or “tier” the various types of renewable technologies based on which technologies a state wants to encourage. The RPS requirements are creating competitive markets for renewable attributes from renewable energy projects, including LFG-fired generation. RECs are the tradable units that allow electric services providers to meet RPS requirements; a typical REC represents the environmental attributes of 1 MWh of electrical generation delivered to the grid. Pricing for RECs varies greatly by state, depending on the RPS regulations and supply and demand for a given renewable generation technology. RECs can also be sold through voluntary markets, more commonly in states without RPS requirements or access to RPS programs within the region. LFG energy project developers and owners should investigate their options to sell RECs generated by the project and should consider obtaining the assistance of a broker or consultant to maximize the value of the REC. Many utilities have already met their obligations for the upcoming years and may not be interested in buying more RECs. It is therefore

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Up to date information about RPSs is available from the Database of State Incentives for Renewables & Efficiency (DSIRE) website.

3 California Environmental Protection Agency, Air Resources Board, Cap-and-Trade Program. https://www.arb.ca.gov/cc/capandtrade/capandtrade.htm.

important that project developers contact all potential buyers to make sure the project being considered can generate sufficient revenues to be financially viable.

U.S. EPA Green Power Partnership

The Green Power Partnership is a voluntary program that encourages organizations to buy green power as a way to reduce the environmental impacts associated with purchased electricity use. The partnership currently has more than 1,300 partner organizations voluntarily purchasing billions of kilowatt-hours of green power annually.

GHG Displacement Credits. An LFG energy project can generate GHG emission reduction credits by displacing more carbon-intensive forms of electric generation on the grid, such as coal and natural gas. Typically, LFG electricity-generating projects may not simultaneously sell RECs and obtain GHG emission reduction credits for the displacement of fossil fuels, because this is considered selling the same environmental attribute twice. However, LFG electricity projects that do not sell RECs (and do not sell the renewable attributes of the energy to their power purchaser by other means) can receive GHG emission reduction credits for the destruction of the LFG if their PSAs allow for these sales. Additionally, some programs provide GHG credits for displacement of fossil fuel use by LFG energy projects that produce thermal energy.

Agreements to sell renewable energy attributes of LFG energy projects can improve the financial feasibility of LFG energy projects, so landfill owners, LFG energy project developers and investors should carefully scrutinize contracts and agreements regarding ownership and sale of these attributes.

5.4 Regulations and Permitting

Landfills and LFG energy projects are subject to federal, state and local air quality, solid waste, water quality and other regulations and permitting requirements. Specific requirements may differ among states. The following section provides general information about regulations and permitting requirements affecting landfills and LFG energy projects. Project developers will need to contact relevant federal, state and local agencies for more detailed and current information on how the various federal, state, and local regulations may apply, and to obtain permit applications for various types of permits. **Project developers are responsible for ensuring compliance with applicable regulations.**

A list of pertinent state agencies is available on LMOP's State Agencies page.

Applicable Clean Air Act (CAA) Regulations

The CAA regulates emissions of pollutants to protect the environment and public health. Several different provisions of the CAA may affect LFG energy projects including: New Source Performance Standards (NSPS) and Emission Guidelines (EG), National Emission Standards for Hazardous Air Pollutants (NESHAP) and Information Collection Authority, which was used to implement the GHG Reporting Program.

NSPS for Internal Combustion Engines. On June 28, 2011, EPA promulgated a final rule on spark ignition internal combustion engines. This final rule requires more stringent standards for stationary compression ignition engines and makes minor revisions to the standards of performance for new stationary spark ignition internal combustion engines in order to correct minor errors and to mirror certain revisions finalized to provide consistency where appropriate for the regulation of stationary internal combustion engines. Rule and implementation information for NSPS for internal combustion engines is available on EPA's webpage for stationary internal combustion engines.

NSPS and EG for MSW Landfills. The NSPS and EG require landfills that exceed certain design capacity and NMOC thresholds to reduce their emissions of LFG, and install and operate a gas control collection system. Subject landfill owner/operators may control gas by combusting it in an enclosed combustion device (such as a boiler, engine or turbine) for energy generation, by using a treatment system that processes the collected gas for sale or beneficial use, or by flaring it. Information on the NSPS and EG can be found online on EPA's NSPS/EG webpage for MSW landfills.

NESHAP for MSW Landfills. On January 16, 2003, EPA published NESHAP requirements (40 CFR part 63, subpart AAAA) for new and existing MSW landfills requiring those meeting certain design capacity, age and emissions criteria to collect and control LFG. Subject landfills that operate part or all of the landfill as a bioreactor must install collection and control systems for the bioreactor before initiating liquids addition. The NESHAP also require semi-annual compliance reporting, instead of the annual reporting required by the NSPS. Rule and implementation information can be found on EPA's NESHAP webpage for MSW landfills.

NESHAP for Internal Combustion Engines. On March 9, 2011, EPA promulgated amendments to NESHAP (40 CFR part 63, subpart ZZZZ) for existing internal combustion engines not already covered by earlier EPA regulations. Originally published in August 2010, the rule added emission standards, monitoring, recordkeeping and reporting requirements for LFG-fired internal combustion engines at major and area sources of hazardous air pollutants. Two main requirements are:

- Existing, non-emergency, spark ignition, LFG-fired engines located at major sources with a site rating greater than or equal to 100 horsepower and less than or equal to 500 horsepower are limited to emissions of carbon monoxide of 177 parts per million by volume on a dry basis at 15 percent oxygen.
- Existing, non-emergency, spark ignition, LFG-fired engines of any size located at area sources have management practice standards instead of a carbon monoxide limit.

EPA promulgated additional amendments to this NESHAP on January 30, 2013 related to alternative testing options for certain engines, management practices for certain engines, and other topics. The final rule and earlier rules are available on EPA's webpage for stationary internal combustion engines.

NESHAP for Major Source Boilers and Process Heaters. On March 21, 2011, EPA promulgated NESHAP (40 CFR part 63, subpart DDDDD) for existing and new boilers and indirect-fired process heaters at major sources of hazardous air pollutants. EPA subsequently published a notice of intent to reconsider specific provisions of the rule. EPA took final action on January 31, 2013. A unit used as a control device to comply with another maximum achievable control technology (MACT) standard is exempt from the rule if greater than 50 percent of its average annual heat input over a 3-year period is from the gas stream regulated under that standard. Otherwise, LFG-fired units will be subject to tune-up work practices if they operate infrequently or at very low loads (as specified in the rule), or have a design heat input capacity less than 10 million British thermal units (MMBtu) per hour, or fire a gas stream that either meets a minimum methane content or heating value or does not exceed the maximum mercury concentration. Units not meeting the above criteria would be subject to emission limits for particulate matter (or non-mercury metals), hydrochloric acid, mercury and carbon monoxide.

On November 20, 2015, EPA finalized revisions to the 2013 amendments as a result of reconsideration of three provisions. Rule and implementation information are available on EPA's webpage for boilers and process heaters.

Reporting of GHGs. Landfills and owners of stationary combustion equipment that burns LFG may be required to report GHG emissions under 40 CFR part 98. Part 98 requires reporting only; it does not contain any emission limits or require any emission reductions. MSW landfills are required to report if their annual methane generation is equivalent to or greater than 25,000 metric tons of carbon dioxide equivalent. For landfills, applicability is based on methane generation (calculated using equations in Part 98) rather than actual emissions. To assist in the determination of applicability, EPA developed an online applicability screening tool that includes a landfill calculation utility. LFG energy projects that are not part of a landfill facility are also required to report GHG emissions from their combustion equipment if they meet the applicability thresholds in Part 98 for listed industrial source categories or for general stationary fuel combustion.

Applicable Permitting Requirements Under the CAA

The CAA regulates emissions of pollutants to protect the environment and public health and contains provisions for New Source Review permits and Title V permits.

Overview of New Source Review (NSR) Permitting. New LFG energy projects may be required to obtain construction permits under the NSR. Depending on the area where the project is located, obtaining these permits may be the most critical aspect of project approval. The combustion of LFG results in emissions of carbon monoxide, oxides of nitrogen and particulate matter. Requirements vary for control of these emissions, depending on local air quality. Applicability of the NSR permitting requirements will depend on the level of emissions resulting from the technology used and the project's location (attainment or nonattainment area).

CAA regulations require new stationary sources and modifications to existing sources of certain air emissions to undergo NSR before they begin construction. The purpose of these regulations is to ensure that sources meet the applicable air quality standards for the area where they are located. Because these regulations are complex, a landfill owner or operator may want to consult an attorney or expert familiar with NSR for more information about permit requirements.

The CAA regulations for attainment and maintenance of ambient air quality standards regulate six criteria pollutants: ozone, nitrogen dioxide, carbon dioxide, particulate matter, sulfur dioxide and lead. The CAA authorizes EPA to set both health- and public welfare-based national ambient air quality standards (NAAQS) for each criteria pollutant. Areas that meet the NAAQS for a particular air pollutant are classified as being in "attainment" for that pollutant, and those that do not are in "nonattainment." Specific permit requirements will vary by state because each state is required to develop an air quality implementation plan (called a State Implementation Plan, or SIP) to attain and maintain compliance with the NAAQS in each Air Quality Control Region within the state. (See 40 CFR 51.160-51.166 for more information on the requirements for developing SIPs including processes for review of new sources and modifications to ensure that they do not interfere with attaining or maintaining the NAAQS.)

The location and size of the LFG energy project will dictate what kind of construction and operating permits are required. If the landfill is located in an area that is in attainment for a particular pollutant, the LFG energy project may have to undergo Prevention of Significant Deterioration (PSD) permitting. Nonattainment area permitting is required for those landfills that are located in areas that do not meet the NAAQS for a particular air pollutant. Furthermore, the estimated level of emissions from the project determines whether the project must undergo major NSR or minor NSR. The requirements of major NSR permitting are greater than those for minor NSR. The following provides more detail on new source permits:

PSD Permitting. PSD review is used in attainment areas to determine whether a new or modified emissions source will cause significant deterioration of local air quality. Permit applicants must assess PSD applicability for each individual pollutant. The PSD major NSR permitting process requires that the applicants determine the maximum degree of reduction achievable through the application of available control technologies for each pollutant for which the source is considered major. Specifically, major sources may have to undergo any or all of the following four PSD steps:

- Best available control technology analysis
- Monitoring of local air quality
- Source impact analysis and modeling
- Additional impact analysis/modeling (impact on vegetation, visibility and Class I areas) (See 40 CFR 52.21 for more information on PSD)

Minor sources and modifications are exempt from this process, but these sources must still obtain state construction and operating air permits. State agencies should be contacted for details and applications.

Nonattainment NSR Air Permitting. A source in an area that has been designated in nonattainment for one or more of the six criteria pollutants may be subject to the nonattainment classification for these pollutants. Ozone is the most pervasive nonattainment pollutant and the one most likely to affect LFG energy projects. Because oxides of nitrogen contribute to ambient ozone formation, ozone nonattainment can lead to stringent control requirements for oxides of nitrogen emitted from LFG energy projects. A proposed new emissions source or modification of an existing source located in a nonattainment area must undergo nonattainment major NSR if the new source or the modification is classified as major (in other words, if the new or modified source exceeds specified emissions thresholds). A project must meet two requirements to obtain a nonattainment major NSR permit for criteria pollutants:

- Must use technology that achieves the lowest achievable emissions rate for the nonattainment pollutant.
- Must arrange for an emissions reduction at an existing combustion source that offsets the emissions from the new project at specific ratios.

Title V Operating Permit Process. Many LFG energy projects must obtain operating permits that satisfy Title V of the 1990 CAA Amendments. Any LFG energy plant that is a major source, or is part of a major source, as defined by the Title V regulation (40 CFR part 70), must obtain an operating permit.

Title V of the CAA requires that all major sources obtain new federally enforceable operating permits. Each major source must submit an application for an operating permit that meets guidelines spelled out in individual state Title V programs. The operating permit describes the emission limits and operating conditions that a facility must satisfy and specifies the reporting requirements that a facility must meet to show compliance with all applicable air pollution regulations. Therefore, the Title V permit will incorporate the specific requirements of the NSPS, EG, NESHAP, PSD and nonattainment NSR that have been determined to apply to the individual LFG energy project. A Title V operating permit must be renewed every 5 years. More information about operating permits are available on EPA's webpage for the Title V program.

Information about how EPA is phasing in the CAA permitting requirements for GHGs is available on EPA's Clean Air Act Permitting for Greenhouse Gases website.

Applicable Resource Conservation and Recovery Act (RCRA) Regulations

Subtitle D. Before an LFG energy project can be developed, all RCRA Subtitle D requirements (requirements for nonhazardous solid waste management) must be satisfied. In particular, methane is explosive in certain concentrations and poses a hazard if it migrates beyond the landfill boundary. LFG collection systems must meet RCRA Subtitle D standards for gas control.

Since October 1979, federal regulations promulgated under Subtitle D of RCRA require controls on the migration of LFG. In 1991, EPA promulgated landfill design and performance standards. These newer standards apply to MSW landfills that were active on or after October 9, 1993. Specifically, the standards require monitoring of LFG and establish performance standards for combustible gas migration control. Monitoring requirements must be met at landfills not only during their operation, but also for 30 years after closure.

Landfills affected by RCRA Subtitle D are required to control gas by establishing a program to periodically check for methane emissions and prevent offsite migration. Landfill owners and operators must ensure that the concentration of methane gas does not exceed:

- Twenty-five percent of the lower explosive limit for methane in facilities' structures.
- The lower explosive limit for methane at the facility boundary.

Permitted limits on methane levels reflect the fact that methane is explosive within the range of 5 to 15 percent concentration in air. If methane emissions exceed permitted limits, corrective action (installation of an LFG collection system) must be taken. Subtitle D may give some landfills an impetus to install energy recovery projects in cases where a gas collection system is required for compliance. See EPA's RCRA webpage for more information.

National Pollutant Discharge Elimination System (NPDES) Permit

LFG condensate forms when water and other vapors condense out of the gas stream because of changes in temperature and pressure within the LFG collection system. This wastewater must be removed from the collection system. In addition, LFG energy projects may generate wastewater from system maintenance. LFG energy projects may need to obtain NPDES permits if wastewater is discharged directly to a receiving water body. These energy projects are categorized as direct sources. NPDES permits regulate discharges of pollutants to surface waters. The authority to issue these permits is delegated to state governments by EPA. The permits, which typically last 5 years, limit the quantity and concentration of pollutants that may be discharged. Permits require wastewater treatment or impose other operating conditions to ensure compliance with the limits. The state water offices or EPA regional office can provide further information on these permits.

The permits are required for three categories of sources and can be issued as individual or general permits. An LFG energy project would be included in the "wastewater discharges to surface water from industrial facilities" category and would require an individual permit. An individual permit application for wastewater discharges typically requires information on:

- Water supply volumes
- Water utilization
- Wastewater flow
- Characteristics and disposal methods
- Planned improvements
- Storm water treatment
- Plant operation
- Materials and chemicals used
- Production
- Other relevant information

LFG energy projects that discharge wastewater to a POTW instead of directly into a water body are categorized as indirect sources and are regulated under the National Pretreatment Program, a subcomponent of the NPDES Permit Program. Under this program, industrial users are required to obtain permits that may specify effluent discharge limits that must be met before wastewater can be conveyed to the POTW. In some cases, pretreatment of the wastewater may be required to meet effluent discharge limits.

Applicable Clean Water Act (CWA) Regulations

Section 401 Certification. LFG recovery collection pipes or distribution pipes from the landfill to a nearby end user may cross streams or wetlands. When construction or operation of these pipes causes any discharge of dredged material into streams or wetlands, the project may require CWA Section 401 certification. The applicant must obtain a water quality certification from the state where the discharge will originate. The certification should then be sent to the U.S. Army Corps of Engineers. The certification indicates that the discharge will comply with the applicable provisions of Sections 301, 302, 303, 306 and 307 of the CWA.

Other Applicable Federal Permit Programs and Regulatory Requirements

The following are brief descriptions of how other federal permits could apply to LFG energy project development:

- **RCRA Subtitle C** could apply to an LFG energy project if it produces hazardous waste. While some LFG energy projects can return condensate to the landfill, many dispose of it through the public sewage system after some form of onsite treatment. In some cases, the condensate may contain concentrations of heavy metals and organic chemicals high enough for it to be classified as a hazardous waste, thus triggering federal Subtitle C regulation.
- Projects that transport LFG via pipeline are subject to 49 CFR part 192 – ***Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*** if the LFG pipeline crosses or impedes public property. The Department of Transportation's OPS is the main regulatory agency responsible for regulating the operation and maintenance of jurisdictional natural gas pipelines. Many state agencies have adopted the regulations and can regulate jurisdictional pipelines within their states.
- **The Historic Preservation Act of 1966 or the Endangered Species Act** could apply if power lines or gas pipelines associated with a project infringe upon a historic site or an area that provides habitat for endangered species.
- Requirements of the **Uniform Relocation Assistance and Real Property Acquisitions Act of 1970**, as amended (Uniform Act), will apply to LFG energy projects if federal funds are used for any part of project design, right-of-way acquisition or construction. The Federal Highway Administration is the lead agency for issues concerning the Uniform Act.