CHAPTER 5

Market Drivers for LFGE Projects

A robust LFGE market can support a range of national and local government goals, including local, sustainable economic development; reduction of GHG emissions; domestic energy security; and mitigation of adverse environmental impacts of landfills, such as local air quality, odor and ground water contamination.[1] LFGE projects can also serve as a hedge against high prices of imported energy and can also increase energy reliability by providing baseload power to the electricity transmission grid, which increases the availability of power.

The viability of the LFGE sector is a direct result of demand for the resulting renewable energy and the cost-competitiveness of the energy as compared with the alternatives. Other policy and market factors can have an important impact on the financial viability of LFGE projects. These factors include trading markets for emerging commodities such as carbon credits and renewable energy credits, as well as a range of financial mechanisms that can, especially in combination, improve the financial return of an LFGE project investment.

This chapter provides an overview of the range of policy and financing mechanisms that are relevant to the creation of a viable LFGE market. The first section presents policies that apply to the major types of uses of gas from the LFGE projects, and the remaining sections address policies and financing mechanisms that can be designed to apply to some or all of the uses. The chapter is intended to assist stakeholders to understand key market issues as they relate to the financing of LFGE projects.

5.1 End-Use Drivers of Demand for LFGE

The primary types of demand for LFGE are examined here: electricity generation, direct use, natural gas pipeline injection and vehicle fuel. In each section, the key factors that incentivize each type of use are summarized.

Electricity Generation

LFGE projects can produce electricity for export to the electricity transmission network (the "grid"); therefore, utility policies can have a profound impact on the financial viability of an LFGE project. Well-designed utility policies can provide greater market certainty to LFGE projects, thus improving the ability to obtain financing.

Interconnection Standards specify the technical and procedural process used to connect electricity generating systems to the electrical grid. LFGE developers should investigate interconnection standards at the outset of a project and consider how the requirements affect the technical and financial viability of the project. Grid interconnection can be a significant issue in evaluating the feasibility of an LFGE project.

Interconnection standards include the technical and contractual arrangements required of system owners and utilities. Public utility commissions or other authorities typically establish standards for interconnection to the electrical distribution grid and standards for interconnection at the high voltage electricity transmission level.

[1] International Energy Agency. 2009. "*Turning a liability into an asset: The importance of policy in fostering landfill gas use worldwide*."

Example: Favorable Interconnection Standards in the State of Iowa, U.S.

As with recent interconnection regulation adoptions in many other U.S. states, Iowa standards set four levels of review for interconnection requests. A project must meet all of the requirements of a given classification to be eligible for that level of expedited review. The level of review required is generally based on system capacity, whether system components are certified by a nationally recognized testing laboratory, and whether the system is connected to a radial distribution circuit or to an area network. The basic definitions for each tier are as follows:[2]

Tier 1: Laboratory-certified, inverter-based systems with a capacity rating of 10 kilowatts (kW) or less.

Tier 2: Laboratory-certified systems with a capacity rating of 2 megawatts (MW) or less, connected to a radial distribution network or a spot network serving one customer.

Tier 3: Laboratory-certified, inverter-based systems with a capacity rating of 50 kW or less that are connected to an area network and that will not export power; or laboratory-certified, non-exporting systems connected to a radial distribution circuit where the aggregate total of all generator nameplate capacity is no more than 10 MW (including the distributed generator applicant).

Tier 4: Systems with a capacity of 10 MW or less that do not meet the criteria for inclusion in a lower tier, including all systems using non-laboratory-certified components and those that require additional construction by the utility accommodate the facility.

Feed-in Tariffs (FiT) provide a regulatory approach that improves the financial viability of renewable energy projects, such as LFGE projects. FiTs require electricity transmission and supply companies to accept electricity from renewable energy projects when it is offered for sale. Under a FiT scenario, electric utilities are obligated to purchase, and in some cases pay a premium price for, the electricity generated from the LFGE project. As a result, the FiT approach assures project developers that there will be a market for the electricity produced by a LFGE project. FiT programs may also require electricity supply companies to enter into long-term power purchase agreements (PPA) with renewable energy providers, which improves investor confidence and lowers the cost of capital for investments in qualifying projects.

National FiT policies have been enacted in 45 countries, including in Europe, South America, North America, Southeast Asia, Central Asia, the

Example: Feed-In Tariff – Thailand[3]

In 2007, and modified in 2009, the government of Thailand enacted a feed-in tariff that provides an “adder” paid on top of utility avoided costs, which is differentiated by technology type and generator size, and guaranteed for 7 to 10 years. Solar receives the highest, 8 baht/kilowatt hour (kWh) (about US$0.27/kWh). Large biomass projects receive the lowest at 0.3 baht/kWh (about US$0.01/kWh). Additional per-kWh subsidies are provided for projects that offset diesel use in remote areas. Under the FiT program, as of March 2010, 1,364 MW of private sector renewable energy was online with an additional 4104 MW in the pipeline with signed PPAs. Biomass makes up the bulk of this capacity: 1,292 MW (on line) and 2,119 MW (PPA only).

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[2] Iowa Administrative Code. Chapter 45: Electronic Interconnection of Distributed Generation Facilities. https://www.legis.iowa.gov/DOCS/ACO/IAC/LINC/03-21-2012.Chapter.199.45.pdf.

[3] “Feed-in premium for renewable power.” Organisation for Economic Co-operation and Development, International Energy Agency. http://www.iea.org/textbase/pm/Default.aspx?mode=re&id=4410&action=detail.

Middle East and Australia. They have also been implemented at the sub-national level in many countries.[4]

Net Metering allows LFGE project operators to offset their electrical use with the electricity generated 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, on-site generation may exceed on-site electricity needs. Net metering provisions have emerged to allow operators to sell their excess electricity to the local power company and receive credit for the amount of electricity provided back to the electrical grid. In these cases, the excess on-site electricity is sent back to the power company either through a second meter for the site, or through a single bi-directional meter. The approach allows the LFGE project to generate and use electricity on-site while maintaining access to grid electricity, and creates a source of revenue for the LFGE project through the sale of excess electricity. Net metering exists at the national level in about 13 countries.[5]

Direct Use

The gas produced at a landfill typically has half the calorific value of natural gas energy sources in the market. As discussed in Chapter 4, while not well-suited for all uses, LFG is less expensive and therefore may be more desirable for those situations that do not require high energy density from the fuel source. In "direct use" applications, the distribution of gas from the landfill to the buyer usually occurs through a dedicated pipeline. LFG can be used to fuel boilers, dryers, kilns, greenhouses and other thermal applications. Industries engaged in direct use of LFG include automobile manufacturing, chemical production, food processing, pharmaceutical, cement and brick manufacturing, wastewater treatment, consumer electronics and products, and prisons and hospitals.

✔ Example: Târgu Mures District Energy in Romania

A 6.5-km landfill gas pipeline transports landfill gas from the Târgu Mures Landfill to the city's four district heating plants.

✔ Example: Vancouver Landfill

Since 1990, an active LFG collection system has operated at the Vancouver Landfill, which is owned and operated by the City of Vancouver in Canada. In 2003, the City of Vancouver expanded the existing collection system, allowing Maxim Power Corporation to pipe LFG to CanAgro Greenhouses; the gas is burned to generate 5.55 MW of electricity for sale to B.C. Hydro and 100,000 GJ/year of heat for sale to CanAgro. The project recovers approximately 500,000 GJ/year of energy. The city will receive revenues of approximately $400,000 per year for the duration of the 20-year contract period.

The key issue that is common to these direct uses is the clean, renewable nature of LFG, which is typically displacing the use of more polluting, and perhaps non-renewable forms of energy. Therefore, a wide variety of renewable energy incentive programs exist at many levels of government that can reduce the costs of project implementation. These programs may take the form of bonds, low interest loans, grants, and a range of tax incentives, each of which is explained further in Section 5.3. For example, in Oregon, U.S., the state's Department of Energy has offered state tax credits and loans such as the State Energy Loan Program since 1981, providing

[4] "Feed-in Tariff." Renewable Energy Policy Network for the 21st Century. http://www.ren21.net/RenewablesPolicy/OverviewonPolicyInstruments/RegulatoryPolicies/FeedinTariff/tabid/5628/Default.aspx.

[5] "Net Metering." Renewable Energy Policy Network for the 21st Century. http://www.ren21.net/RenewablesPolicy/OverviewonPolicyInstruments/RegulatoryPolicies/NetMetereing/tabid/5648/Default.aspx.

loans with favorable terms to renewable energy projects. Since 1984, this program has provided $454 million in support.

Natural Gas Pipeline Injection

Processing LFG to produce pipeline-quality gas requires removal of CO_2 and other impurities. The main obstacles to supplying LFG into the natural gas distribution grid are typically the cost of upgrading the gas and a lack of standards concerning gas quality requirements, injection and measurement procedures. Clear guidelines and regulations are needed to promote investments in upgrading LFG, and standardized procedures help to reduce the time and cost required to access the pipeline network. Other factors that affect the sale of pipeline-quality LFG include the type of pipeline (transmission or distribution) and the structure of relevant energy policies. The primary advantage to injecting LFG into the natural gas grid is the ability to reach a larger market. In the European market, this access was updated in a 2009 EU directive that provides for "non-discriminatory access" to the natural gas transmission network, provided that technical and safety standards are met.[6]

EU Renewable Interconnect Directive[7]

- Article 16 (7): Member States shall ensure that charging of transmission and distribution tariffs does not discriminate against electricity from renewable sources, in particular in peripheral regions. Member States shall ensure that charging of transmission and distribution tariffs does not discriminate against gas from renewable sources.

Example: Biogas Injection into the Natural Gas Distribution Grid[8]

In the Santiago Norte landfill in Chile, biogas will be treated to meet the sales specifications of Metrogas S.A. in an upgrading facility, where most of the non-methane gases will be removed before the biogas is injected to the distribution grid. Project estimates are that an annual average of 70 million cubic meters of biogas will be injected into the distribution grid, equivalent to an average of 1,238 terajoules per year in the first 7-year crediting period, avoiding the consumption of an average of 37 million cubic meters of natural gas per year. The gas will be used in homes, businesses and vehicles. The emission reductions estimated for the first 7-year crediting period are more than 420,000 tonnes of carbon dioxide equivalent, an average of 60,969 tCO_2e per year.

Vehicle Fuel

Landfill gas can be treated to produce either compressed natural gas (CNG) or liquid natural gas (LNG), each of which can be used as vehicle fuel. A common option for the use of LFG-produced CNG or LNG is to fuel a fleet of local vehicles such as those operating at the landfill or community-wide vehicle fleets such as garbage trucks or utility service vehicles. According to the European Commission, 19 percent of the total GHG emissions and 28 percent of the CO_2 emissions in the EU can be attributed to the transport sector, with road transport accounting for more than 90 percent of total EU transport-related

[6] Official Journal of the European Union. 2009. *DIRECTIVE 2009/73/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC.*

[7] Official Journal of the European Union. 2009. *DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009*, Article 16.

[8] "Metrogas – Biogas injection to the natural gas distribution grid." United Nations Framework Convention on Climate Change. Clean Development Mechanism, Project Design Document Form. Section A.2, p. 2.

emissions. Between 1990 and 2005, transport-related emissions increased even as total EU emissions declined following the growth in both passenger (28 percent) and freight (62 percent) transport. As a result, the EU views the use of renewable natural gas, such as LFG, for vehicle fuel as essential for achieving its emission reduction goals.[9]

A low carbon fuels standard (LCFS) can promote the use of LFG fuels in vehicles because of the very low GHG emissions associated with the entire lifecycle of landfill gas CNG and LNG.[11] In the U.S., California is the first state to have adopted an LCFS, one of several requirements of the state's Global Warming Solutions Act of 2006. The California LCFS requires that at least a 10 percent reduction in carbon intensity be achieved from California's use of transportation fuel by 2020; the calculation of carbon intensity includes the complete life-cycle of production, transport, distribution and use of the fuel. The program includes credit trading to reduce the average cost of compliance. Although the program is being challenged in the judicial system, the state is proceeding with its implementation.

The European Green Cars Initiative[10]

To help reduce GHG emissions from the transport sector, the European Green Cars Initiative encourages three categories of action:

- Research and Development, mainly through grants for research on greening road transport. Budget: € 1 billion, of which € 500 million from the European Commission, matched by € 500 million from industry and Member States
- Support to industrial innovation through European Investment Bank loans; the budget is € 4 billion per year (in addition to existing loans)
- Demand side measures and public procurement, such as reduction of circulation and registration taxes for low-CO_2 cars

Example: Use of LFG as an Alternative Fuel for the Urban Bus Fleet in Linköping, Sweden[12]

In the early 1990s, the City of Linköping, Sweden, was converting the city's bus fleet to an alternative fuel to reduce the local pollution from diesel buses. Natural gas was an alternative that was considered. The City of Linköping decided to use locally produced biogas as fuel in the urban bus fleet. The Linköping biogas plant has made it possible for the City of Linköping to decrease the CO_2-emissions from urban transport by 9,000 tons per year and also to decrease the local emissions of dust, sulfur and nitrogen oxides.

5.2 Trading Markets

Increasing concerns about climate change and the emergence of trading systems for carbon and renewable energy provide an important source of demand for LFG because LFG constitutes a renewable source of natural gas that can displace non-renewable fossil fuel sources of natural gas. These markets represent an additional source of revenue for LFGE projects that can make them more financially attractive to implement.

9 Ibid.

10 "Developing greener road transport." European Commission. http://ec.europa.eu/research/industrial_technologies/developing-greener-road-transport_en.html.

11 Argonne National Laboratory. 2010. *Well-to-Wheels Analysis of Landfill Gas-Based Pathways and Their Addition to the GREET Model*. http://www.transportation.anl.gov/pdfs/TA/632.PDF.

12 "100% Biogas for Urban Transport in Linköping, Sweden: Biogas in Buses, Cars and Trains." Biogas in the Society. http://www.iea-biogas.net/_download/linkoping_final.pdf.

Carbon Trading

Joint Implementation and **Clean Development Mechanism** reductions in methane emissions can generate additional revenue for an LFGE project when the reductions meet the requirements for creating carbon offsets, such as those that can be created under the "flexibility mechanisms" of the Kyoto Protocol. The mechanism known as "joint implementation," defined in Article 6 of the Kyoto Protocol, allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (an Annex B "Party;" see Table 5-1) to buy emission reduction units (ERUs) from an emission-reduction or emission removal project in another Annex B country, which can be counted toward meeting the Kyoto target of the purchasing country.

Table 5-1. Kyoto Protocol Annex B Parties[13]

Country	Target (1990** - 2008/2012)
EU-15*, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland	-8%
US***	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0
Norway	+1%
Australia	+8%
Iceland	+10%

* The 15 States who were EU members in 1997 when the Kyoto Protocol was adopted, took on that 8 percent target that will be redistributed among themselves, taking advantage of a scheme under the Protocol known as a "bubble," whereby countries have different individual targets, but when combined, make an overall target for that group of countries. The EU has already reached agreement on how its targets will be redistributed.

** Some EITs have a baseline other than 1990.

*** The U.S. has indicated its intention not to ratify the Kyoto Protocol.

Note: Although they are listed in the Convention's Annex I, Belarus and Turkey are not included in the Protocol's Annex B, as they were not Parties to the convention when the protocol was adopted.

Joint implementation offers the ERU buyer country a flexible and cost-efficient means of fulfilling a portion of its Kyoto commitments, while the ERU seller country benefits from the foreign investment and technology transfer associated with the project that creates the ERUs. As of October 2011, 33 LFGE projects were registered with ERUs within the JI mechanisms.[14]

Internationally, the role of CDM has been central to providing additional financial revenue to methane capture and destruction projects at landfills. As defined in Article 12 of the Kyoto Protocol, CDM allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project (such as LFGE) in developing countries (non-Annex B countries). These emission reduction projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO_2, which can be counted toward meeting Kyoto targets.[15] These reductions allow the Annex B Party countries to meet their obligations through the use of CERs from the implementation of CDM emission reduction projects in developing countries.

[13] "Countries included in Annex B to the Kyoto Protocol and their emissions targets." United Nations. Framework Convention on Climate Change. Kyoto Protocol: Targets. http://unfccc.int/kyoto_protocol/items/3145.php.
[14] "JI projects." UNEP Risoe Centre. http://cdmpipeline.org/ji-projects.htm.
[15] "Clean Development Mechanism (CDM)." United Nations. Framework Convention on Climate Change. http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php.

When evaluating LFGE projects, the potential revenue from CERs should be taken into account because it may make a project viable or profitable.

CER revenue that makes an LFGE project viable may help to satisfy CDM requirements for "additionality," in which additionality refers to the "additional" CERs that would not be achieved without the LFGE project. As of October 2011, there were 193 LFGE projects that had registered within the CDM mechanism.[16]

Determining Additionality

The United Nations Framework Convention on Climate Change's (UNFCCC) Tool for the Demonstration and Assessment of Additionality provides information about how to determine whether a proposed project meets the additionality requirements of the CDM. Related information can be found at http://cdm.unfccc.int/Reference/tools/.

Other credit trading programs, including mandatory and voluntary programs, are also available, such as the EU Emissions Trading Scheme begun in 2003 and the New Zealand Emission Trading Scheme, which was the first mandatory, economy-wide scheme outside Europe. Australia has adopted a carbon tax law for energy-intensive industries that includes emission trading beginning in 2015.[17] China has announced emission trading programs for key cities and provinces in 2013, with the expectation of subsequent expansion to the national level.[18] At the sub-national levels, the State of California in the U.S. is implementing the components of its economy-wide carbon cap-and-trade program, and is working to link its state program with corresponding programs in the Canadian province of Quebec.[19] Voluntary markets also exist such as Japan's Voluntary Emission Trading Scheme (JVETS),[20] the Verified Carbon Standard (VCS) and the Climate Action Reserve (CAR), as does over-the-counter (OTC) trading of carbon derivatives. Alternative market instruments are being considered or are emerging in countries such as Brazil, China, India, Mexico and the Republic of Korea.

Renewable Energy Markets

Markets for renewable energy are driven by requirements on electricity utilities to produce or procure a specified amount of their overall electricity supply from renewable energy sources such as LFGE projects. Renewable energy requirements are referred to differently depending on the country; for example, in the United States they are typically called a Renewable Electricity Standard (RES), in the United Kingdom they are called the Renewables Obligation, and in the EU they are referred to as renewable or quota obligations. Renewable energy requirements mandate that electricity providers document the type of fuel that was used to generate the electricity purchased (or created) by the provider and require that a minimum portion of electricity be produced from renewable fuel sources. Countries will often establish a schedule for phasing in renewable energy requirements that increase the percentages of renewable energy used over time. Such requirements may also include "set-asides" or "carve-outs" that

Example: Renewable Obligations

Renewable obligations have been introduced in many countries, including Belgium, India, Italy, Sweden, UK, Poland and Romania.

[16] "CDM projects grouped by types." UNEP Risoe Centre. http://cdmpipeline.org/cdm-projects-type.htm.

[17] "Clean energy legislation." Australian Government. Department of Climate Change and Energy Efficiency. http://www.climatechange.gov.au/en/government/clean-energy-future/legislation.aspx.

[18] "China to pilot carbon trading scheme: NDRC." China Daily. http://www.chinadaily.com.cn/bizchina/2011-11/23/content_14145909.htm.

[19] "Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions." Discussion Draft. California Air Resources Board. March 30, 2012. http://www.arb.ca.gov/cc/capandtrade/draftregquebeclink.pdf.

[20] "Japan's Voluntary Emissions Trading Scheme (JVETS)." Office of Market Mechanisms Climate Change Policy Division, Ministry of the Environment, Japan. May 2011. http://www.env.go.jp/en/earth/ets/jvets1105.pdf.

require utilities to use a renewable resource (such as LFG) to meet a specified percentage of their electricity, which is defined in terms of generating capacity or retail electricity sales.

Regulatory approaches are often structured to include a trading system in which renewable energy generators such as LFGE projects earn Renewable Energy Certificates (RECs) for each unit of electricity produced. RECs allow market participants and electricity regulators to track the amount and type of renewable power being bought and sold. RECs also financially reward eligible renewable energy producers because RECS can be sold by the power producer to the electricity utility companies (power provider). Utility companies that purchase the RECs then submit the certificates to a regulatory body to comply with the company's obligations under the renewable energy regulation. In this way, a renewable energy regulation can provide regulated entities with additional compliance flexibility through the use of a market to reduce compliance costs. At least 13 countries have renewable energy requirements in place.

European Union Commitments[21]

- Article 16 (9): Where relevant, Member States shall assess the need to extend existing gas network infrastructure to facilitate integration of gas from renewable sources.
- Article 16 (10): Where relevant, Member States shall require transmission system operators and distribution system operators in their territory to publish technical rules in line with Article 6 of Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning the common rules for the internal market in natural gas, in particular regarding network connection rules that include gas quality, gas odoration and gas pressure requirements. Member States shall also require transmission and distribution system operators to publish the connection tariffs to connect renewable gas sources based on transparent and non-discriminatory criteria.

Renewable Energy Regulations

Regulations may apply a multiplier to each unit of electricity produced by a specified technology (such as LFGE) to support specific renewable energy technologies. For example, an LFGE multiplier of five provides the LFGE project with five certificates for each unit of electricity produced with LFGE. These multipliers may be designed to direct revenue, investment and job creation to a particular type of renewable energy or create "grid parity" by making renewable energy competitive with traditional sources (fossil fuel-based). Regulations may also impose penalties on energy providers that do not meet renewable energy obligations, cap the cost of procuring renewable energy, or suspend the requirement of procuring renewable energy if the cost of meeting the obligations becomes too high.

5.3 Financial Mechanisms

In addition to establishing regulatory requirements, government energy policy can be designed to encourage various energy goals. Energy policy at many levels of government can target and promote LFGE by providing financial incentives to promote the development of landfill gas energy resources. The specifics of these approaches can be very different, and may change over time, because government policy and priorities differ among and within countries. Therefore, each measure must be carefully reviewed for the specific provisions that must be satisfied for projects to qualify, and for provisions that may limit or alter the annual financial benefit over time, including possible expiration dates or termination provisions.

[21] Official Journal of the European Union. 2009. *DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009*, Article 16.

Tax Incentives

Governments are uniquely positioned to affect the financial viability of a project through the availability of tax incentives. These incentives can be designed to reduce the tax burden of projects in proportion to activities such as capital expenditures or productive output. For example, at the federal level, the United States has programs such as the renewable electricity production tax credit (PTC), and the business energy investment tax credit (ITC).

Public-Private Partnerships

The term "public-private partnerships" (PPP) refers to arrangements between the public and private sectors that allow a portion of the services or works that traditionally have been the responsibilities of government to be provided by the private sector, with clear agreement on the division of responsibility, revenues and risk for delivery of infrastructure and or services.

Public-private partnerships include a range of approaches for including the expertise or capital of the private sector. For example, public services that have traditionally been delivered by government entities can be contracted to the private sector. Alternatively, services may be publicly administered with the private sector involved in financing, constructing, operating and possibly taking ownership of an asset.

Public-Private Partnerships

The Canadian Council for Public-Private Partnerships defines public-private partnerships as follows:[22]

A cooperative venture between the public and private sectors, built on the expertise of each partner, which best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards.

Example: Public-Private Partnership

The International Finance Corporation of the World Bank is advising the Government of Kosovo on a public-private partnership to rehabilitate and operate existing landfills according to environmental best practices and EU landfill directives. The landfills, which are operated by the Kosovo Landfill Management Company, are currently treated as dumpsites.[23]

Bond Financing

For government-owned landfills or end users, tax deferred bonds can be used to help finance LFGE projects. These bonds can be a cost-effective method of financing a project since the interest rate is often lower than commercial debt interest rates and can often be structured for long repayment periods. In the United States, a federal bond program was developed for Clean Renewable Energy Bonds (CREBs). This approach provides a tax credit for bond holders rather than interest payments.[24]

Direct Municipal Funding

Direct municipal funding refers to the use of local government operating budgets to fund LFGE projects, eliminating the need to obtain outside financing or partners and potentially avoiding delays caused from their project evaluation needs. However, municipalities may not always have the resources available to

[22] The Canadian Council for Public-Private Partnerships. http://www.pppcouncil.ca/resources/about-ppp/definitions.html.

[23] International Finance Corporation. *IFC Advisory Services in Public-Private Partnerships: Ongoing transactions in Europe & Central Asia*. http://www1.ifc.org/wps/wcm/connect/5215e1004983917a84c4d6336b93d75f/ActiveMandates_ECA.pdf?MOD=AJPERES&CACHEID=5215e1004983917a84c4d6336b93d75f.

[24] National Renewable Energy Laboratory. 2009. *Fact Sheet Series on Financing Renewable Energy Projects: Financing Public Sector Projects with Clean Renewable Energy Bonds (CREBs).* http://www.nrel.gov/docs/fy10osti/46605.pdf.

finance an entire project and may need to explore alternatives, such as public-private partnerships. In addition, municipalities may be required to seek public approval of government-funded projects, which may result in additional time needed to implement LFGE projects.

Loan Guarantees

Governments, as well as some multinational banks (such as the World Bank Group, The African Development Bank (AfDB), The Asian Development Bank (ADB), The European Bank for Reconstruction and Development (EBRD), and The Inter-American Development Bank Group (IDB)) may provide loan guarantees to smaller lenders for projects that support certain policy goals, such as renewable energy projects. These loan guarantees can be especially helpful for situations when the smaller lenders are not as experienced with renewable energy technologies or financing, or both, and so may not provide favorable terms for promising renewable energy projects. The availability of a loan guarantee can allow loans for these projects to be provided, which supports the commercialization of renewable energy to sustain economic growth, yield environmental benefits and produce a more stable and secure energy supply.

✔ Example: Renewable Energy Loans

The African Development Bank and Eskom, South Africa's largest electric company, signed renewable energy loans worth USD$365M to support South Africa's long-term plans for moving to a lower carbon growth path. Leveraging and accelerating the disbursement of concessional climate financing is essential to achieve economic viability of some of the clean technology solutions.[25]

Equity Financing

An approach to financing LFGE projects involves investors who are willing to fund all or a portion of the project in return for a share of project ownership. Such investors typically use either public or private sources of funds.

Private Equity. Potential investors include developers, equipment vendors, gas suppliers, industrial companies and often investment banks. This option typically has lower transaction costs and may deliver financing more quickly than other options. However, private equity financing can be more expensive than other financing options because of requirements for higher returns. In addition, investors may expect to receive benefits from providing funding, such as service contracts or equipment sales, as well as a portion of the cash flow.

Public Equity. Many governments use a variety of approaches to direct financial support to major projects in other countries if the development of those projects meets the financial, social and political criteria of the investing country. These approaches include financial support from multinational organizations mentioned above, the WB, the AfDB, the ADB, the EBRD, and the IDB, as well as several groups within the United Nations. Furthermore, many countries have agencies that invest in projects directly, rather than, or in addition to supporting the multinational entities. Examples of these "bilateral" institutions include the German Development Bank (KfW), the Canadian International Development Agency (CIDA) and the French Development Agency (AFD).[26]

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[25] "AfDB, Eskom Sign USD365M Renewable Energy Loans." African Development Bank Group. http://www.afdb.org/en/news-and-events/article/afdb-eskom-sign-usd365m-renewable-energy-loans-8385/.

[26] For more information, see: http://www.climatefundsupdate.org/global-trends/global-finance-architecture.

Renewable Energy Investment Forum

The Renewable Energy Investment Forum was formed in 2003 to support collaboration among renewable energy project investors. The forum focuses on projects that reduce or eliminate dependence on fossil petroleum and other high-risk, high-cost technologies. Initial screening criteria for consideration of a candidate project include:

- Proven, off-the-shelf technologies with many years of commercial use in the environment and at the scale intended by the project sponsors.
- Experienced, reputable project sponsors and management teams.
- An asset basis, credit history and above-average credit scores for principals or sponsors.
- Reasonable return given the opportunity, current economy and history.
- The project must have sufficient upside to easily afford debt service, which is usually demonstrated by carefully structured and detailed financial plans for the life of the project.
- Depending on power purchase arrangements, project sponsors must allow for likely changes in energy prices, full equipment maintenance, amortization and labor (operating) costs.

Public Benefit Funds

Public Benefit Funds (PBFs), which are a financial resource created by applying a fee onto customers' utility rates, are another mechanism to support policy objectives (such as developing LFGE projects). Revenue generated by the fee can be used by public institutions and governments to increase the availability of renewable energy, and can result in investment in LFGE projects. PBFs can also be administered by public-benefit corporations that are chartered by a government and designed to support a specified public benefit. A public authority is a type of public-benefit corporation that takes on the role of maintenance of public infrastructure (such as LFGE projects) and may have powers to regulate or maintain public property (such as LFGE equipment). In the United States, PBFs are in place in 30 states and the District of Columbia.[27]

Grants

Grant programs can offer support for a broad range of landfill gas technologies or can focus on promoting a single technology. Grants may be made available to the commercial, industrial, utility, education or government sectors. These programs are often designed to contribute to the cost of eligible LFGE systems or equipment. Alternatively, grants may focus on LFGE research and development, feasibility studies, project demonstrations or support project commercialization. Available grant funds are typically distributed through a competitive process.

[27] U.S. Department of Energy, Energy Efficiency and Renewable Energy. 2010. *Public Benefit Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities*. http://www1.eere.energy.gov/manufacturing/states/pdfs/pbf_factsheet.pdf.

Examples: Renewable Energy Grants

In the United States, a grant program was developed by the Department of Treasury to support investment in renewable energy, allowing a facility owner to receive a one-time grant equal to 30 percent of the construction and installation costs for the facility if the facility is depreciable or amortizable.[28] Other grant opportunities are available in the U.S. through public and private sources.[29]

The Bulgarian Energy Efficiency and Renewable Energy Credit Line (BEERECL) provides grants of up to 15 percent of the investment amount required for qualifying renewable energy projects, including biogas.

Best Practices for Understanding Market Drivers for LFGE Projects

It is important that stakeholders recognize and understand how policy and market drivers affect the development of LFGE resources and support the long-term sustainability of LFGE projects. Policy and financing mechanisms are central to assessing the financial viability of LFGE projects. While market drivers and financing mechanisms will vary by country and region, the demand for renewable energy and cost-competitiveness of that energy compared with alternatives should be assessed carefully during the planning stages of an LFGE project to ensure that the most effective combination of revenue opportunities is harnessed.

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[28] U.S. Department of the Treasury. Recovery Act. http://www.treasury.gov/initiatives/recovery/Pages/1603.aspx.

[29] U.S. Department of Energy and North Carolina State University. Database of State Incentives for Renewables and Efficiency. Summary Maps. http://www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1.