Global Methane Initiative

Agriculture Subcommittee

A Global Perspective of Anaerobic Digestion Policies and Incentives

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Countries in Focus

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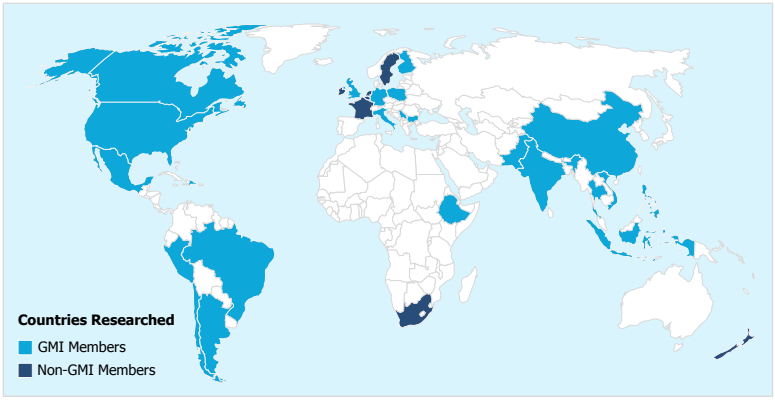
Countries In Focus	
GMI Member Countries:	Argentina, Brazil, Bulgaria, Canada, Chile, China, Dominican Republic, Ethiopia, Finland, Germany, India, Indonesia, Italy, Mexico, Pakistan, Peru, Philippines, Poland, Serbia, Thailand, United Kingdom, United States, Vietnam
Other Countries:	Belgium, France, Ireland, Netherlands, New Zealand, South Africa, Sweden

Executive Summary

Developed by the Global Methane Initiative's (GMI) Agriculture Subcommittee, this report provides an overview of policies, regulations and government incentives used to promote anaerobic digestion (AD) in 30 countries. Country-specific examples, reflecting diverse approaches and in-country circumstances, are presented to showcase successful policies and incentives that foster consideration and development of AD projects. The target international audience includes GMI Partner Country representatives; GMI Project Network members; local, regional and national policy influencers; project developers and financing organizations; industry representatives; non-governmental organizations; and universities, academics and researchers.



Research Methodology. This report presents information collected from representatives of GMI and non-GMI Partner Countries and information obtained through Internet searches.

Global Implementation of Anaerobic Digestion

Anaerobic digestion is used effectively around the world to manage waste streams of all volumes. Small-scale digesters provide fuel and electricity in rural farming communities. Large-scale anaerobic digestion systems are used on industrial farms and by communities to co-digest other sources of organic wastes. Today's most advanced projects use anaerobic digestion to reduce greenhouse gas (GHG) emissions, supply electricity to the electrical grid, generate renewable natural gas, control water pollution and produce valuable byproducts.

> Renewable, sustainable energy generation is projected to be the fastest-growing energy sector over the next two decades (International Energy Agency).

While AD is commercially proven, it has not realized its full potential in many countries because of high costs, unfamiliarity with AD itself and a lack of policy drivers and incentives. Farmers and investors alike are concerned about high capital costs, limited incentives, difficulties connecting to the electrical grid, price uncertainly for the biogas produced and the timeframe to realize a return on investment. Aligning regulatory frameworks and incentives is essential for encouraging the development of new AD projects. Several key drivers shape how countries can leverage policies and incentives to advance anaerobic digestion:

- Creating financial incentives for investments in anaerobic digestion
- Reducing energy expenses by using power generated by anaerobic digesters
- Accounting for the environmental benefits of anaerobic digestion

Policies and Regulations

Agriculture and renewable energy regulatory frameworks influence adoption and implementation of anaerobic digestion. Interest in anaerobic digestion has increased globally as governments work to reduce GHG emissions and identify alternative energy sources for increasing populations. Information gathered during the research for this report indicates that most countries have enacted broad biofuel legislation that, while not specific to anaerobic digestion, encourages implementation of the technology. There has been significant growth in the AD sector in countries with specific anaerobic digestion policies—for example, Canada, the United Kingdom and the United States.

Summary of Policies and Incentives for the 30 Countries Researched

Country	AD Policies	Renewable Energy Targets	GHG Emission Reduction Targets	AD Incentives
Argentina		■		■
Belgium	■	■	■	■
Brazil		■	■	
Bulgaria	■	■	■	■
Canada	■		■	■
Chile		■	■	
China	■	■	■	■
Dominican Republic		■	■	■
Ethiopia				■
Finland	■	■	■	■
France	■	■	■	■
Germany	■	■	■	■
India	■	■		■
Indonesia	■	■	■	■
Ireland	■	■	■	■
Italy	■	■	■	■
Mexico	■		■	■
Netherlands	■	■	■	■
New Zealand	■	■	■	■
Pakistan		■		■
Peru		■		■
Philippines				■
Poland	■		■	■
Serbia		■	■	■
South Africa	■		■	■
Sweden	■	■	■	■
Thailand	■	■	■	■
United Kingdom	■	■	■	■
United States	■	■	■	■
Vietnam	■	■	■	■

Incentives

Incentives play an important role in ensuring the success and viability of AD projects. Despite the well-documented benefits of AD, projects present financial challenges such as securing investment capital to design and build anaerobic digestion systems. Additionally, long-term operation and maintenance costs cannot be recouped easily through normal agricultural business practices. Many governments offer incentives for AD projects to increase the economic feasibility and attractiveness of AD systems by offsetting costs and generating revenue streams.

Other Drivers that Affect Anaerobic Digestion

Many governments are exploring other approaches to boost interest in the benefits of anaerobic digestion and promote the development of more AD systems. Growing interest to establish mandatory requirements to divert organic materials from landfills is encouraging implementation of AD systems as a practical means to manage organic waste and increase the financial viability of AD projects. Additionally, public-private partnerships are proving to be a successful approach to address the impact of agro-industrial practices on water and soil quality.

Increasing Awareness

Many governments are turning to anaerobic digestion as a means to achieve GHG reductions in the agriculture sector in addition to producing renewable energy and improving nutrient management practices. Advancements in digester design, along with supportive regulations and incentives, continue to make AD a more feasible and practical solution for small- and large-scale waste management and environmental challenges. Research conducted for this report confirms that policies and incentives play a key role in determining the viability and scale of AD projects.

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Abbreviations and Acronyms

AD	Anaerobic Digestion
AFO	Animal Feeding Operation
AIA	Integrated Environmental Authorization
AQUA	Adoption of Quality Water Use in Agro-Industry Sector
ARS	Argentine Peso (currency code)
BAT	Best Available Technology
BGN	Bulgarian Lev (currency code)
BHT	Thai Baht (currency code)
BMP	Best Management Practice
CAFO	Concentrated Animal Feeding Operation
CAP	Common Agricultural Policy
CBIN	Canadian Biomass Innovation Network
CCL	Climate Change Levy
CHP	Combined Heat and Power
CNMP	Comprehensive Nutrient Management Plan
CNY	Chinese Yuan (currency code)
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CWA	Clean Water Act
EEG	Renewable Energy Sources Act (Germany)
EPA	U.S. Environmental Protection Agency
EU	European Union
EU ETS	European Union Emissions Trading System
EUR	Euros (currency code)
FIT	Feed-in Tariff
GHG	Greenhouse Gas
GMI	Global Methane Initiative
ITC	Investment Tax Credit
ISPO	Indonesian Sustainable Palm Oil
kW	Kilowatt
kWel	Kilowatt Electricity
kWh	Kilowatt Hour
MEXICO2	Mexican Carbon Platform
MW	Megawatt
MWh	Megawatt hour
NGO	Non-governmental Organization
NVZ	Nitrate Vulnerable Zone
NZU	New Zealand Units
p	British pence (currency code)
PLANET	Planning Land Applications of Nutrients for Efficiency and the Environment
POME	Palm Oil Mill Effluent
REC	Renewable Energy Credit
RET	Renewable Energy Target
RFS	Renewable Fuel Standard
RHI	Renewable Heat Incentive
RIN	Renewable Identification Number System
RNG	Renewable Natural Gas
ROC	Renewables Obligation Certificate
RTFO	Renewable Transport Fuel Obligation
UK	United Kingdom
U.S.	United States
VOC	Volatile Organic Compound

Introduction

The Global Methane Initiative's (GMI) *A Global Perspective of Anaerobic Digestion Policies and Incentives* provides a broad overview of policies, regulations and government incentives that are used in countries around the world to promote anaerobic digestion (AD). Country-specific examples, reflecting assorted approaches and in-country circumstances, are presented to showcase successful policies and incentives that foster consideration and development of AD projects.

Developed by GMI's Agriculture Subcommittee, this report presents information about 30 countries, identified in Exhibit 1. Information was collected directly from representatives of GMI Partner Countries. In addition, information received during development of the report from representatives of non-GMI countries about the implementation of AD-relevant policies and incentives was incorporated into the research. Finally, Internet searches were performed for additional resources.

The target international audience for the report is large, diverse, and far-reaching, including GMI Partner Country representatives; GMI Project Network members; local, regional and national policy influencers; project developers and financing organizations; industry representatives; non-governmental organizations (NGO); and universities, academics and researchers. Exhibit 2 identifies how this report aligns to the specific interests of the target audiences.

The purpose of this report is to:

- Promote policy development in both GMI and non-GMI countries and encourage national leaders to improve existing policies and incentives.
- Advance the creation of an online resource for international policies, programs and incentives that affect AD projects.
- Encourage interest in future research and resource development to stimulate new AD projects and foster beneficial policies and incentives.

Exhibit 1. Countries Researched for This Report

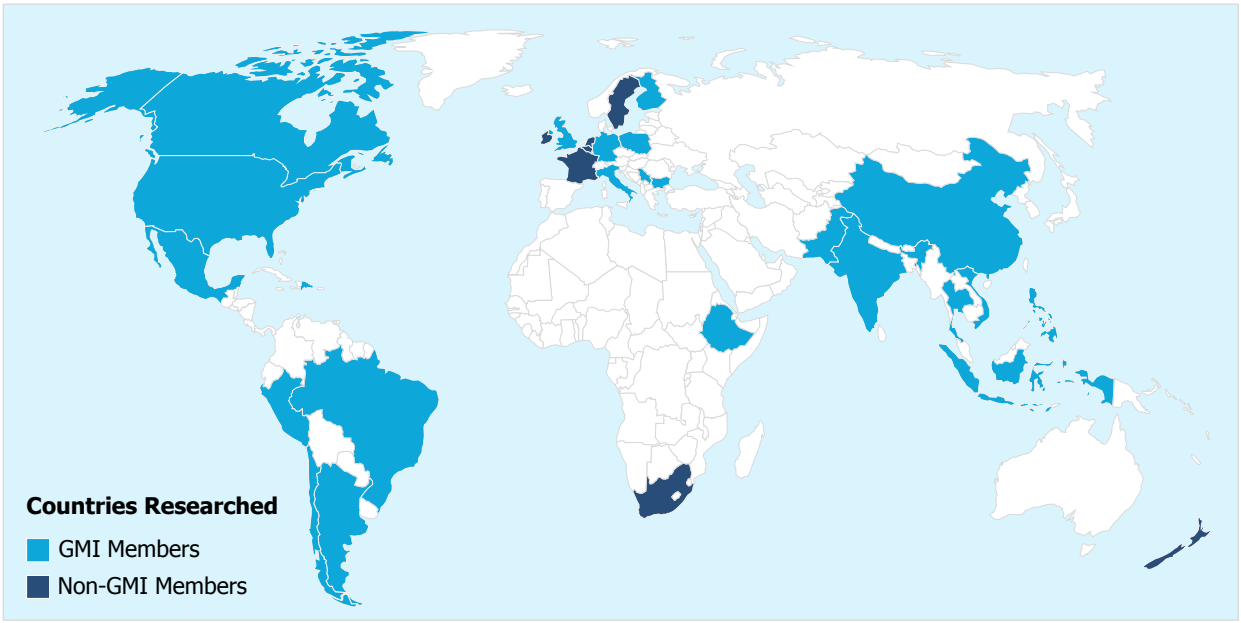
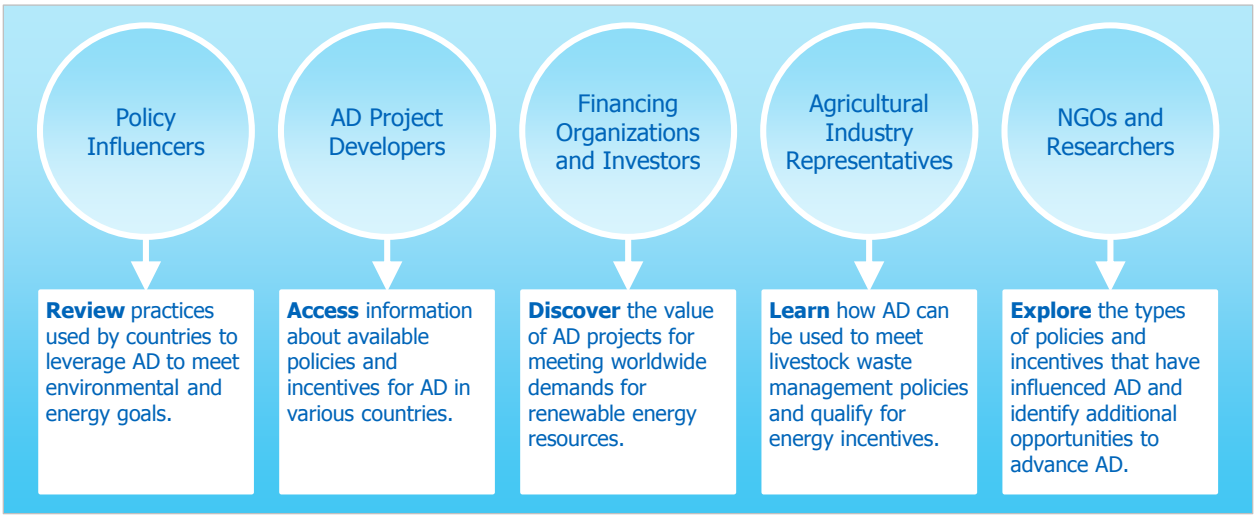


Exhibit 2. Audiences for This Report



About the GMI Agriculture Subcommittee

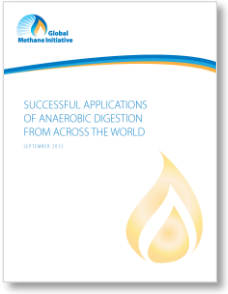
GMI is a voluntary, multilateral partnership that aims to reduce global methane emissions and to advance the abatement, recovery and use of methane as a valuable clean energy source. GMI achieves this goal by creating an international network of partner governments, private sector members, development banks, universities and NGOs to build capacity, develop strategies and markets, and remove barriers to project development for methane reduction in partner countries.

Visit GMI's website at **www.globalmethane.org** to learn more about the initiative.

The website features project spotlights, a database of GMI methane reduction activities, additional tools and resources, and an online calendar of events.

The GMI Agriculture Subcommittee is dedicated to reducing the impacts of climate change by providing international leadership to mitigate global methane emissions through the abatement, recovery, and use of methane from agricultural sources. The Subcommittee, co-chaired by Argentina, India and the United States, promotes collaboration between delegates from Partner Countries and Project Network members to support development of methane mitigation projects to increase environmental quality, improve rural livelihoods, strengthen the economy and expand opportunities for renewable energy production and use.

Case Studies of Global Anaerobic Digestion Projects



Published in September 2013, the GMI report "Successful Applications of Anaerobic Digestion from Across the World" describes the environmental, financial, social and health benefits of AD projects and provides highlights about various technologies and partners involved in these projects.

The report is available for downloading at www.globalmethane.org/documents/GMI Benefits Report.pdf.

1 Global Implementation of Anaerobic Digestion

Anaerobic digestion is used effectively around the world to manage waste streams of all volumes. Small-scale digesters produce biogas from livestock waste to provide fuel and electricity in rural farming communities. Large-scale AD systems are used on industrial farms and by communities to co-digest other sources of organic wastes. Geographically, the largest numbers of anaerobic digester plants operate in Asia, though most are small scale, with more than 6 million digesters in China and India alone. Countries in Europe have the most advanced anaerobic digestion industry, with many AD systems serving more than one livestock operator. The anaerobic digestion process is also rapidly gaining popularity in Africa and biogas recovery is emerging in other regions of the world.

Anaerobic digestion systems may be sized for small family or village farms and large industrial farms.

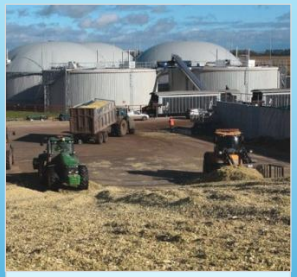
System designs for AD projects continue to evolve as technologies emerge and projects become more economically feasible. Today's most advanced projects use anaerobic digestion to reduce GHG emissions, supply electricity to the electrical grid, generate renewable natural gas (RNG), control water pollution through the management of nutrients, and produce valuable byproducts such as bedding for livestock, organic fertilizer, compost, chemicals and building materials. Exhibit 3 illustrates the most common uses for AD in agricultural settings.

Exhibit 3. AD Systems Provide Energy and Improve the Environment around the World[1,2]

AD offers a viable solution to recover and use the methane produced from livestock waste.
Livestock accounts for approximately 29 percent of global methane emissions, of which 3 percent comes from manure management. By 2030, livestock methane emissions are projected to increase by 20 percent.

Small-scale digesters produce fuel and electricity for millions of people worldwide without access to an electric grid.

Advanced AD systems provide renewable energy sources to meet growing needs for electricity, heat and transportation fuel.



AD improves the long-term sustainability of agriculture operations and provides alternatives for organic waste management.

Farmers use AD to manage manure and reduce nutrient runoff that affects the quality of local streams and water bodies.

[1] U.S. Environmental Protection Agency. *Global Mitigation of Non-CO_2 Greenhouse Gases: 2010-2030*, EPA-430-R-13-011. 2013. http://www.epa.gov/climatechange/EPAactivities/economics/nonco2mitigation.html.

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Potential for New Projects and Barriers to Implementation

While AD is commercially proven, it has not realized its full potential in many countries because of high costs, unfamiliarity with AD itself and a lack of policy drivers and incentives. Farmers and financial investors alike are concerned about high capital costs for design and construction, limited incentives for investors, difficulties connecting to the electrical grid, price uncertainty for the biogas produced and the timeframe to realize a return on investment. Unfamiliarity with AD technologies is a significant barrier, particularly for financial investors who are more likely to fund other types of renewable energy projects, such as wind and solar, because they do not understand how AD works and the benefits such projects produce. However, as documented on the following pages, several countries are successfully promoting AD. European governments have led the world in pursuing policies and promoting mechanisms to advance the use of biogas. In turn, other regions are building on the lessons learned in Europe to promote AD projects as a means to reduce greenhouse gas (GHG) emissions, improve the sustainability of the agriculture sector and provide renewable energy resources.

Renewable, sustainable energy generation is projected to be the fastest-growing energy sector over the next two decades (International Energy Agency).

Opportunities for Policies and Incentives to Advance AD

Aligning regulatory frameworks and incentives to help farmers is essential for encouraging the development of new AD projects. Several key drivers shape how countries can leverage policies and incentives to advance anaerobic digestion:

- **Creating financial incentives for investments in anaerobic digestion.** AD projects become more attractive to investors when financial incentives help offset capital and operations costs. Incentives can allow AD projects to generate revenue by selling excess electricity to the electrical grid, collecting fees for waste intake and reducing their tax burdens. Incentives may also provide premium prices for biogas.
- **Reducing energy expenses by using power generated by anaerobic digesters.** Biogas and thermal energy production from digesters can be converted into usable energy, which can reduce or replace the site's existing electricity, gas and heat usage. Policies and incentives can be structured to allow owners to maximize savings on those heat and electricity bills.
- **Accounting for the environmental benefits of anaerobic digestion.** AD provides many environmental benefits, including directly reducing GHG emissions by reducing methane emissions from manure management and indirectly, by displacing the use of fossil fuels. Digesters can also help to prevent contamination of ground water, surface water and other resources by controlling nutrient runoff and reducing harmful pathogens. Countries can shape policies and incentives to quantify and create market value for the environmental benefits of anaerobic digesters, which can be used in trading systems to achieve net benefits.

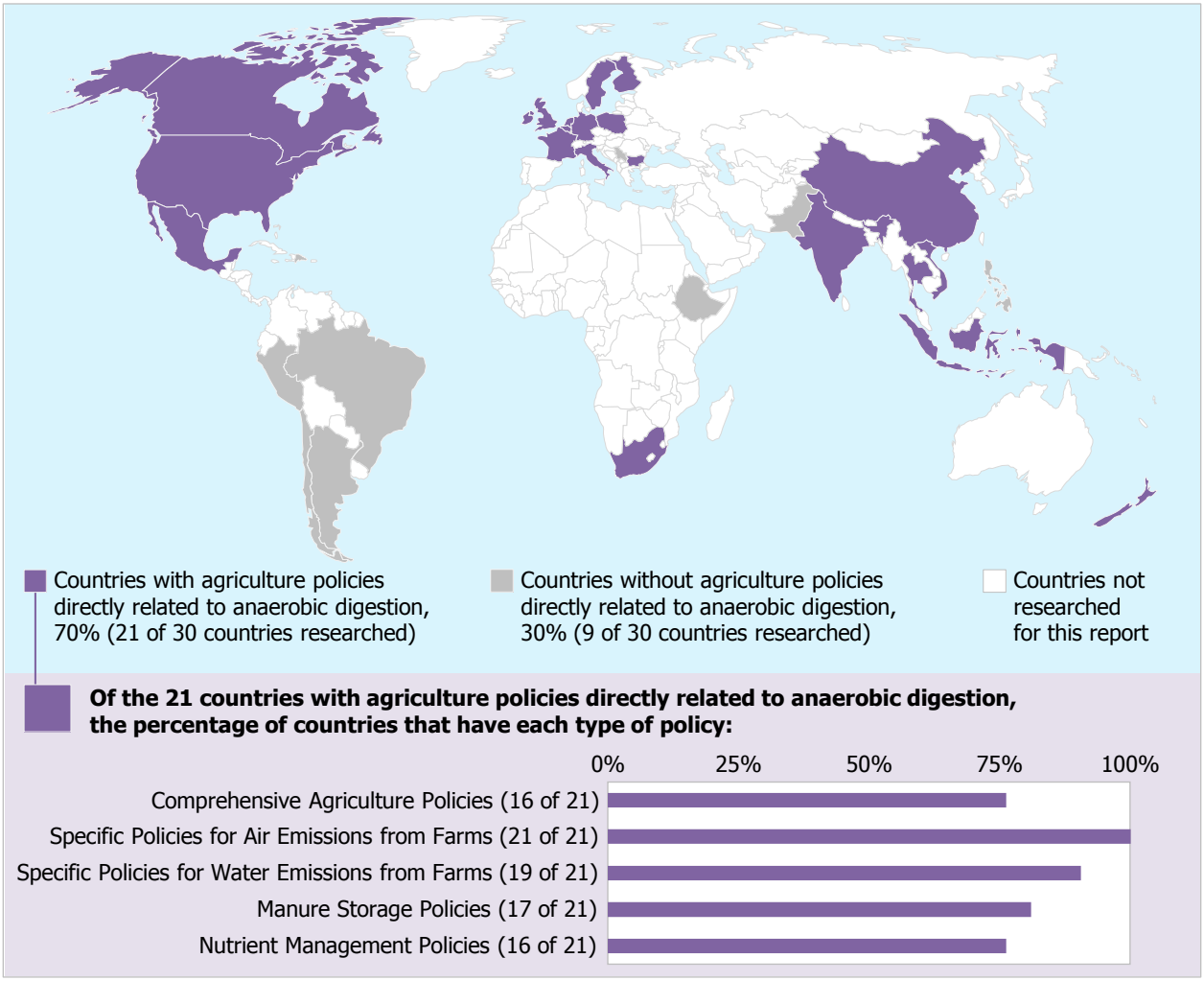
The next two chapters present a summary of the types of policies and incentives currently used by countries to advance AD, including real-world examples from around the globe.

2 Policies and Regulations

Regulatory frameworks for agriculture and renewable energy are important factors that influence the adoption and implementation of anaerobic digesters as well as the availability of specific feedstock materials. Well-developed regulatory and policy frameworks encourage owners and developers to implement renewable energy systems and, in the context of this report, anaerobic digester systems in the agricultural sector. Interest in AD has increased globally as governments work to reduce greenhouse gas emissions and identify alternative energy sources for growing populations.

Information gathered during research for this report indicates that most countries have enacted broad biofuel legislation that, while not specific to anaerobic digestion, encourages implementation of the technology (see Exhibit 4). It is noteworthy that there has been significant growth in the AD sector in countries where legislation specifically for anaerobic digestion has been enacted — for example, Canada, the United Kingdom and the United States.

Exhibit 4. Countries with Agriculture Policies for Anaerobic Digestion



Most of the regulations and policies that encourage implementation of AD technology can be categorized as follows: comprehensive agriculture regulations, air emission regulations, water discharge regulations, manure storage regulations, nutrient management policies and renewable energy-related regulations. A summary of each of these categories is discussed in the following pages, along with country-specific examples. A comprehensive list that indicates which of the countries researched have comprehensive agriculture policies for AD and specific regulations for air or water emissions from farms, manure storage and nutrient management is provided in Table 1 on page 12.

Comprehensive Agriculture Policies and Regulations

Most environmental and agricultural agencies have established a suite of agriculture and livestock production policies and regulations that include provisions for air emissions, water discharge and nutrient management. Anaerobic digestion projects are associated with several of these agricultural waste streams. Effective management of wastes generated from an AD project can eliminate direct waste discharges to the environment. Additionally, direct discharge of waste to the land, a water body or to the atmosphere usually requires the facility to meet permitting requirements and obtain permission from a regulatory agency.

In accordance with their regulations, approximately half of the countries researched have in place best management practices (BMP), or similar guidelines, as well as monitoring and reporting requirements. The BMPs typically include methods for feedstock collection, handling and storage; recommendations for digestate storage; and strategies that reduce odors and fugitive dust. For example, a BMP relevant for AD would include ensuring that trucks containing animal waste feedstock traveling between a farm and an AD system are restricted to pre-determined traffic routes separate from routes used by trucks that contain food products or feed in order to reduce the potential for cross-contamination. Another BMP related to storage would include ensuring consistency in how feedstock is loaded into storage systems, as well as the size and types of storage systems used.

Canada (British Columbia) — Environmental Management Act

This legislation provides the Ministry of Environment the authority to regulate waste management and pollution within British Columbia.

- ✓ **Agriculture Waste Control Regulation** – provides information about acceptable agricultural practices for management of agricultural waste, including use and storage. Per Part 4, agricultural waste must be held in a storage facility, as field storage, or if the waste is from an animal, under their outdoor pens.[3]
- ✓ **Code of Practice for Soil Amendments** – requires a facility to develop a land application plan prior to discharge.

[3] British Columbia Reg. 131/92 – Environmental Management Act Part 4. http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_131_92#CodeofAgriculturalPracticeforWasteManagement,April1,1992

European Union (EU) member states	Common Agricultural Policy (CAP)

The Common Agricultural Policy (CAP) is the agricultural policy of the EU. It was introduced in 1962 and has been reformed several times, most recently in 2013. The CAP allows European farmers to meet the needs of 500 million Europeans. Its main objectives are to ensure a decent standard of living for farmers and to provide a stable and safe food supply at affordable prices for consumers. The latest reform, in June 2013, focused on three priorities: viable food production, sustainable management of natural resources and balanced development of rural areas throughout the EU.[4]

Air Emissions from Farms

The agriculture sector is a significant contributor of GHG emissions and other pollutants. Air pollutants are emitted from manure and include ammonia, hydrogen sulfide, nitrous oxide, methane and carbon dioxide (CO_2) gases as well as volatile organic compounds (VOC), particulate matter and odor. These air pollutants can cause serious environmental concerns and health problems. Based on research conducted for this report, 21 of the 30 countries assessed have air policies that limit the amount of methane and other pollutants that can be emitted to the atmosphere. Additionally, in general terms, countries that have more stringent air emission policies also employ more modernized agriculture farming practices, which tend to produce fewer emissions.

Anaerobic digesters are not emissions-free. Digesters can generate air contaminants either directly via the digestion process, or indirectly via combustion of the gas generated from the anaerobic digester. Air emissions can be discharged from flares, boilers or from cogeneration equipment, but these discharges can be managed with pollution control devices.

Italy	National Environmental Framework Law (152/2006)

In Italy the amount of air emissions (ammonia, hydrogen sulfide, nitrous oxide, methane, carbon dioxide and VOCs) and odors from farms is limited by the National Environmental Framework Law (152/2006, part V) and further integration and modifications of the law (especially Legislative Decree 128/2010).

Depending on the type and the number of animals, the farm is requested to apply for different levels of authorizations. Large farms and those farms subject to the Integrated Pollution Prevention and Control Directive need to apply for the Integrated Environmental Authorization (AIA). The AIA requires farmers to apply Best Available Technologies (BAT) for manure storage, handling and spreading; furthermore, they must ensure continuous monitoring and improvement of the environmental parameters. Farms that are not required to comply with AIA in terms of air emissions can apply for a General Authorization that includes specific measures (such as capacity building for the employees, BAT for animal recovery, and coverage of any powder storage volume).

In Italy, the Nitrates Action Plan does not specify a limit on the emissions of farms themselves. The Good Agriculture Practice Codes define technical and economic criteria for emissions control. The following measures are considered: covering storage tanks, manure handling (which is aimed at minimizing the retention time inside the farm), and spreading techniques (earthening).

[4] European Commission. The Common Agricultural Policy. A Partnership between Europe and Farmers. 2012. http://ec.europa.eu/agriculture/cap-overview/2012_en.pdf

Indonesia	Indonesian Sustainable Palm Oil (ISPO) Policy

The central Government of Indonesia adopted the Indonesian Sustainable Palm Oil (ISPO) policy in 2011. This objective of this policy is to work toward reducing greenhouse gas emissions, improving sustainability and increasing the competitiveness of Indonesian palm oil in the global market. The ISPO, implemented by the Ministry of Agriculture, mandates palm oil plantations to register an emissions reduction plan, including methane capture for treatment of palm oil mill effluent (POME) by December 31, 2014. In other words, the ISPO policy mandates a reduction in GHGs from the palm oil sector, which directly and almost exclusively applies to anaerobic digesters fed with POME.[5]

Indonesia is the world's largest palm oil producer. Thus, implementation and enforcement of the ISPO certification scheme would represent significant potential reductions in methane emissions from the palm oil, and more generally, from the agriculture sector.

South Africa	Air Quality Amendment Act (2013)

The Air Quality Amendment Act aims to protect the environment and prevent air pollution by setting ambient air quality standards at the national level and allows for stricter provincial standards. Other measures introduced by this act include measures to control dust, noise and offensive odors. Emitters are also required to apply for an atmospheric emission license.

Additionally, national departments, provinces and municipalities are required to include an air quality management plan in their environmental implementation plan. Air quality management plans must address, in addition to other requirements, the emissions from any point or non-point source of air pollution and incorporate best practices in air quality management. Air quality management plans must be implemented and annual reporting is required. Additionally, pollution prevention plans are required for any emitters of priority air pollutants.[6]

Water Emissions

Agricultural operations; in particular, the animal wastes from livestock operations, are one of the leading contributors to water pollution. AD systems offer an effective means to manage animal wastes and the digestion process produces a digestate (liquid effluent) that can be used beneficially as fertilizer. However, the AD process also produces water emissions and if improperly managed, water discharge from a digester can impair groundwater and surface water quality.

More than half of the countries represented in this report have established policies and regulations that limit effluent discharge with the purpose of preserving water quality. Many countries do not require farming operations to obtain any additional water discharge permits or authorizations for an AD system if manure is the only feedstock managed in the digester. The majority of countries with established water emission limits require submittal of an action plan or management program that outlines nutrient land application rules as well as measures that will be implemented to meet permitting requirements related to the operation's effluent discharge.

[5] Indonesian Sustainable Palm Oil (ISPO). http://www.ispo-org.or.id/index.php?lang=en

[6] Republic of South Africa. Government Gazette – No 39. Of 2004: National Environment Management: Air Quality Act, 2004. http://www.tshwane.gov.za/Services/EnvironmentalManagement/Environmental%20Management%20Documents/National%20Air%20Quality%20Act.pdf

United States	Federal Water Pollution Control Act

The objective of the Federal Water Pollution Control Act, otherwise referred to as the Clean Water Act (CWA), is to protect and restore the nation's waters by regulating allowable discharges and preventing point and nonpoint pollution sources. In the agricultural sector, the CWA regulates Concentrated Animal Feeding Operations (CAFOs) that discharge or propose to discharge to the nation's waters and requires these facilities to obtain a National Pollutant Discharge Elimination System permit. Discharges include the result of inappropriate land application of manure. Large CAFOs that discharge must be permitted and develop and maintain Nutrient Management Plans to ensure the appropriate application of manure. [7]

EU member states	Nitrates Directive (1991)

The purpose of this directive is to protect water quality in Europe by reducing nitrates from agricultural sources and preventing further such pollution, while promoting best practices for farming and livestock management. This directive is an integral part of the Water Framework Directive (2000), which establishes a comprehensive, cross-border approach to water protection organized around river basin districts.

Member states must identify polluted water bodies or those at risk of pollution, designate areas of land that are at vulnerable to nitrate pollution as "Nitrate Vulnerable Zones (NVZ)" and establish Codes of Good Agricultural Practice and Action Programmes. These Codes include a number of requirements relating to manure management and fertilizer application, including from livestock.

The Nitrates Directive has been shown to contribute to reducing water pollution, with positive effects also on methane, ammonia and nitrous oxide emissions. This is due to the overall impact from better manure management and optimal fertilizer use limited to crop needs. Further implementation of the Nitrates Directive will also help with the resource efficiency of both manure and mineral fertilizers.[8]

Manure Storage

More than half of the countries examined for this report have instituted manure management policies that outline the collection, storage and processing of livestock manure to prevent surface and groundwater contamination as well as reduce nuisance odors. Typically, manure is stored in various holding facilities on farms for several months and then used as fertilizer. By instituting policies on manure storage, countries encourage use of AD systems to mitigate odor while providing storage.

Belgium	Manure Decree (2007)

The purpose of the Manure Decree is to reduce nitrate and phosphate water pollution attributable to agricultural operations. The decree sets limits on the amount of nitrate and phosphate fertilizer that can be applied to specific soil types or crops. A standard of 50 milligrams for residual nitrate in soil was established. After every growing season, soils are tested to measure residual nitrate concentrations.[9]

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[7] U.S. Environmental Protection Agency. AgSTAR. Permitting Practices for Co-digestion Anaerobic Digester Systems. http://www.epa.gov/agstar/tools/permitting.html

[8] European Commission. The Nitrates Directive. http://ec.europa.eu/environment/water/water-nitrates/

[9] Soil Service of Belgium. Jan Bries, Annemie Elsen, Hilde Vandendriessche. 2014. http://bdb.be/Portals/0/docs/sci201401.pdf

United States	Chesapeake Bay Program

The Chesapeake Bay Program, established in 1983, is a watershed-level partnership that works to preserve the water quality of the Chesapeake Bay, promote land conservation and educate the public. Partnership tools include the use of a Watershed Model that provides scenarios on manure and chemical fertilizer application, plant uptake, nitrogen fixation, land use, areas of erodible land and nitrogen concentrations from septic system drainage fields. Additionally, several objectives were established per the program's Directive Number 04-3, including reducing the nutrient content in animal manure and poultry litter by practicing feed management and coordinating the transport of manure relocation and transport.[10]

United Kingdom	Nitrate Pollution Prevention (Amendment) Regulations

These regulations limit the amount of time that manure can be stored and aim to reduce the amount of nitrates, derived from the application of nitrogen fertilizer and organic manures, that enter surface and groundwater in NVZs in England. An amendment in 2009 increased the limit of livestock manure of 170 kilograms of nitrogen per hectare per year to 250 kilograms of nitrogen per hectare per year on grassland farms.[11]

Nutrient Management

Mismanagement of manure can cause serious impacts to surface water bodies because of the amount of nitrogen and phosphorus in the manure. These impacts can lead to contamination of drinking water supplies, eutrophication, growth of algae and a decrease in water oxygen levels that negatively affects the survival of aquatic organisms. An effective best practice that has been successful in mitigating these impacts is development of a Comprehensive Nutrient Management Plan (CNMP). The CNMP has become an integral part of the regulatory permitting and environmental stewardship for animal feeding operations (AFO) of all sizes in several countries. A CNMP is developed to assist an animal feeding operation to meet nutrient levels and water quality goals and regulations. AD does not reduce the nutrient value of manure. The process converts nitrogen and phosphorous into forms that can readily absorbed by plants and reduces the total volume of manure produced through evaporative loss. Post-digestion solid-liquid separation can be used to retain phosphorous in the solid waste and nitrogen in the liquid portion of the digestate and other post-digestion technologies can also be applied to extract additional nitrogen and phosphorus.[12]

Nutrient management policies, in place in 16 out of 30 of the countries reviewed, encourage AD system implementation because the use of digestate as a fertilizer provides farmers with greater flexibility in regards to time and areas of application. Additionally, AD is effective at pathogen

[10] Chesapeake Bay Program. Estimates of County-Level Nitrogen and Phosphorus Date for Use in Modeling Pollutant Reduction. http://www.chesapeakebay.net/publications/title/estimates_of_county-level_nitrogen_and_phosphorus_date_for_use_in_modeling

[11] United Kingdom. The Nitrate Pollution Prevention (Amendment) Regulations 2009.

[12] U.S. Department of Agriculture. Comprehensive Nutrient Management Planning (CNMP) Background. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/tx/technical/ecoscience/agronomy/?cid=nrcs144p2_003089

reduction, and applying digestate instead of untreated manure to agricultural fields reduces the likelihood of surface water pathogen contamination from the application of manure.[13]

India	National Biogas and Manure Management Program

The goal of the National Biogas and Manure Management Program is to reduce methane emissions and encourage the utilization of livestock waste as not only a fertilizer but also as a renewable energy source. The program promotes the use of small, family-type biogas plants that use manure as feedstock with the intended purpose of providing fuel for domestic cooking, reducing deforestation, improving living conditions and enhancing village sanitation. The program provides financial assistance including subsidies on capital costs, system repair and training. Government agencies use a monitoring system to report the results of field inspections and independent agency study evaluations of biogas plant functionality.[14]

United Kingdom	Technical Advice and Tools for Manure Nutrient Management

The U.K. is a member state of the European Commission and therefore, as discussed earlier in this report, enforces the 1991 Nitrates Directive. The U.K. has developed technical advice to improve manure nutrient management and to comply with national and international guidelines and policies to control environmental pollution. In particular for anaerobic digesters, manure from livestock is classified as a waste and, as such, a facility that accepts manure as feedstock must register for an environmental permit or obtain an exemption. If the feedstock is made up of only livestock manure, digestate output is not classified as a waste and can be used as a fertilizer.

The U.K also offers software to aid in planning nutrient land application. This software is titled "Planning Land Applications of Nutrients for Efficiency and the Environment (PLANET)" and can be used to develop a manure application plan for fields.[15]

Summary of Policies and Regulations

Provided below is a summary table of countries that have regulations directly related to agriculture; air emissions from farms; water emissions; manure storage; and nutrient, fertilizer, or manure requirements. Information was gathered based on contributions of GMI and non-GMI partner representatives and research of available online resources.

[13] Moser. M.A. Anaerobic Digesters Control Odors, Reduce Pathogens, Improve Nutrient Manageability, Can be Cost Competitive with Lagoons, and Provide Energy Too. http://epa.gov/agstar/documents/lib-man_man.pdf

[14] Global Methane Initiative. India Country Profile on Animal Waste Management for Methane to Markets. https://www.globalmethane.org/documents/ag_cap_india.pdf

[15] United Kingdom. Nutrients, fertilizers and manure. https://www.gov.uk/managing-nutrients-and-fertilisers

Table 1. Types of Agricultural Policies and Regulations Used by the Countries Researched for This Report

Country	Comprehensive Agriculture Regulations	Air Emissions from Farms	Water Emissions	Manure Storage	Nutrient Management
Belgium	✓	✓	✓	✓	✓
Bulgaria	✓	✓	✓	✓	✓
Canada	✓	✓	✓	✓	✓
China	✓	✓	✓		
Finland	✓	✓	✓	✓	✓
France	✓	✓	✓	✓	✓
Germany	✓	✓	✓	✓	✓
India	✓	✓	✓	✓	✓
Indonesia		✓			
Ireland	✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓
Mexico	✓	✓	✓	✓	✓
Netherlands	✓	✓	✓	✓	✓
New Zealand		✓	✓		✓
Poland	✓	✓	✓	✓	✓
South Africa		✓			
Sweden	✓	✓	✓	✓	✓
Thailand		✓	✓	✓	
United Kingdom	✓	✓	✓	✓	✓
United States	✓	✓	✓	✓	✓
Vietnam		✓	✓	✓	

Renewable Energy-Related Policies and Regulations

Countries typically regulate energy production through a collection of statues, regulations, polices and common law. Many countries have developed or are starting to develop national policies or laws that specifically address renewable energy sources. Most renewable energy regulations focus on solar power, wind power, hydropower and power from biomass (which includes AD).

Renewable energy generation targets and GHG emission reduction targets for the countries examined in this report are provided in Exhibit 5. Aggressive targets are usually accompanied by policies that aim to reduce barriers to the development of renewable energy facilities. The majority of countries researched for this report have renewable energy-related policies that encourage development and use of renewable energy and incorporate renewable energy generation targets and GHG emission reduction targets.

Germany — Renewable Energy Sources Act (EEG) and Biofuels Quota Act

In 2012, renewable energy supplied 22 percent of the country's electrical supply, which has been made possible through aggressive legislation geared to encourage renewable energy development.[16] The Renewable Energy Sources Act of 2000 (and amended in 2014) provides incentives for electricity generation from renewable energy by offering above market feed-in tariffs, priority connection rights to feed into the grid, specialized equalization schemes, and the passing of transmission system costs to electricity consumers by means of an EEG surcharge.[17]

The Biofuels Quota Act of 2007 sets a minimum share of biofuels to be sold in the energy market. In 2010, the minimum share attributable to domestic biofuels was 6.75 percent and the goal for 2015 is 8 percent.[18]

Chile — Non-Conventional Renewable Energy Law

This 2008 law promotes development of renewable energy sources by requiring utilities to source 5 percent of the total electricity supply from non-conventional energy sources. Energy from renewable sources can either be produced by the utility or can be purchased through third-party agreements with non-conventional energy source providers. Recently, the government set a new target, mandating that 20 percent of the country's electricity be produced from non-conventional renewable sources by 2025. Electricity produced from hydropower plants with capacities below 20 megawatts is considered non-conventional whereas only a portion of energy produced from hydropower plants with capacities between 20 and 40 megawatts is considered non-conventional. Non-compliance with the law will result in fines.[19] Additionally, regulations were promulgated in 2013 that reduced the renewable energy permitting process from 700 to 150 days.[20]

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[16] BBC. Can Germany afford its 'energy bender' shift to green power? http://www.bbc.com/news/science-environment-23127175

[17] German Federal Ministry for Economic Affairs and Energy. The Renewable Energy Sources Act. http://www.erneuerbare-energien.de/EE/Navigation/DE/Gesetze/Das_EEG/das_eeg.html

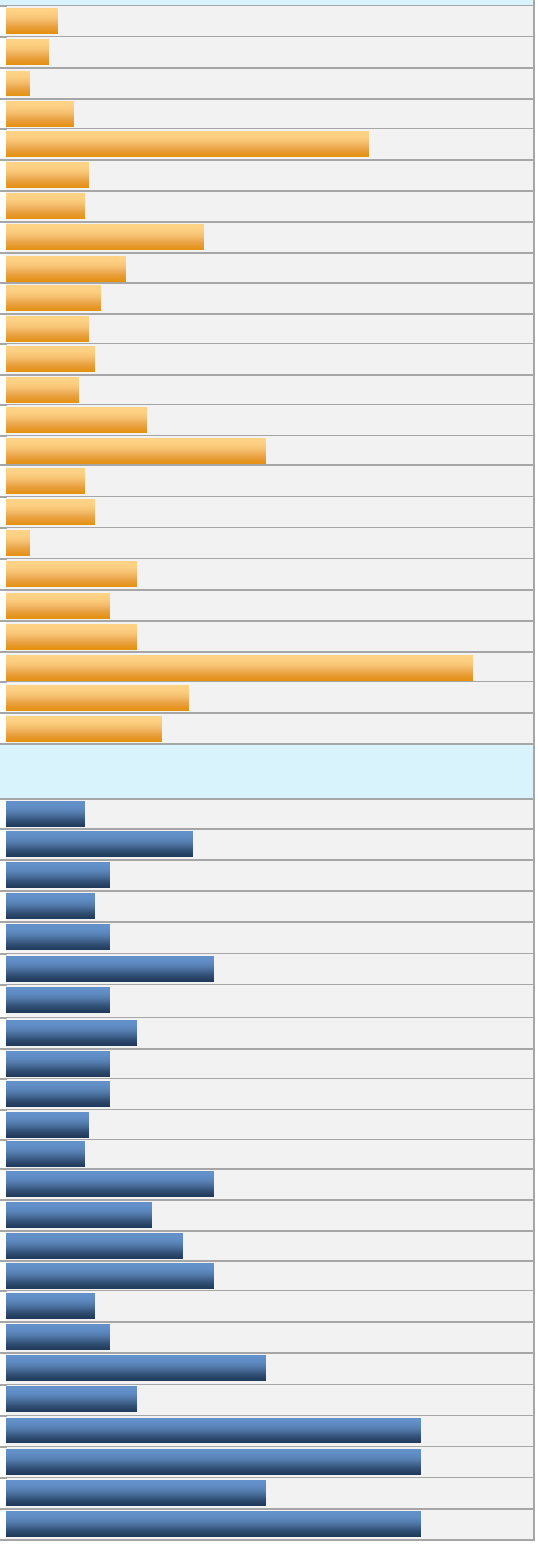
[18] Odyssee-Mure. GER 24 Biofiel Quota Act (Biokraftstoffquotengesetz). http://www.measures-odyssee-mure.eu/public/mure_pdf/transport/GER24.PDF

[19] International Energy Agency. Non-conventional renewable energy law (Law 20.257). http://www.iea.org/policiesandmeasures/pams/chile/name,24577,en.php

[20] Renewable Energy Policy Network for the 21st Century. Renewables 2014 Global Status Report. 2014. http://www.ren21.net/Portals/0/documents/Resources/GSR/2014/GSR2014_full%20report_low%20res.pdf

Exhibit 5. Targets for Renewable Energy Generation and GHG Emission Reductions by Country

Year	Country	Target
Percentage of Energy Generated from Renewable Sources		
2015	Pakistan	10%
2016	Argentina	8%
2018	Peru	5%
2020	Belgium	13%
	Brazil	70%
	Bulgaria	16%
	China	15%
	Finland	38%
	France	23%
	Germany	18%
	Ireland	16%
	Italy	17%
	Netherlands	14%
	Serbia	27%
	Sweden	50%
	United Kingdom	15%
	United States	17%
	Vietnam	4.5%
2021	Thailand	25%
2025	Chile	20%
	Dominican Republic	25%
	New Zealand	90%
2050	India	35%
	Indonesia	30%
Percentage of Reductions in GHG Emissions		
2020	Belgium	15%
	Brazil	36%
	Bulgaria	20%
	Canada	17%
	Chile	20%
	China	40%
	France	20%
	Indonesia	26%
	Ireland	20%
	Italy	20%
	Netherlands	16%
	New Zealand	15%
	Poland	40%
	Serbia	28%
	South Africa	34%
	Sweden	40%
	United States	17%
	Vietnam	20%
2030	Dominican Republic	50%
	Thailand	25%
2050	Finland	80%
	Germany	80%
	Mexico	50%
	United Kingdom	80%



GMI Member Countries

Renewable Energy Generation Targets

Renewable energy targets are requirements that stipulate that a specific proportion of the energy consumed comes from renewable energy sources within a certain timeframe. Renewable energy targets are often put in place through legislation and, in some cases, specifically target biogas from the anaerobic digestion of manure and organic wastes that can be used to generate electricity, heat or fuel. Higher renewable energy targets usually come with a set of government incentives geared toward encouraging developers to implement systems that generate non-conventional energy such as AD systems.

All EU member states (28 in total) have policy targets for renewable energy that can be found in each country's National Renewable Energy Action Plan. The EU baseline target is 20 percent by 2020. The United States also has a national Renewable Energy Target (RET) of 17 percent by 2020. In Canada, each of the country's nine provinces has a RET, but there is no national RET. In addition, many countries, particularly EU nations, have RETs specific for biogas and biomethane.

Exhibit 5 lists the specific targets for the percentage of energy that comes from renewable sources for the countries researched for this report. The targets differ by year, although many countries have set targets for 2020. Most countries that have set targets have set them between 10 and 20 percent, while a few have established more ambitious goals. For example, Brazil has set a goal of 70 percent for renewable energy by 2020 and New Zealand has a goal of 90 percent by 2025.

Greenhouse Gas Emission Reduction Targets

Several countries have developed a coordinated set of goals and policies to meet GHG emission reduction targets and some specifically address the use of AD. Of the countries researched in this report, 24 have pledged to reduce their GHG emissions with amounts ranging from 15 to 80 percent. Anaerobic digestion reduces the amount of GHG emissions released to the atmosphere by capturing methane, a potent greenhouse gas, during the digestion process that otherwise would have been released to the atmosphere from typical methods of treatment or disposal. The use of methane as fuel also offsets the amount of fossil fuel that would have been used to provide power or heat.

Most of the countries researched for this report have established targets for reductions in greenhouse gas emissions. Short-term goals (that is, by 2020) range from 20 to 40 percent reductions. Four countries, Finland, Germany, Mexico and the United Kingdom, have set much higher goals over a longer timeframe (by 2050). It is also worth noting that Ethiopia has set a target for maintaining its current GHG emissions while anticipating significant growth. Exhibit 5 presents the greenhouse gas emission reduction targets.

Country-Level Energy Planning

Comprehensive and holistic ways of planning and implementing energy actions at the national level have been developed for many countries. Action plans in several countries include a commitment to increase energy output from livestock manure processed at AD facilities, while other countries discuss energy planning in terms of biogas. Country-level energy planning may include the development of regulatory frameworks that link economic opportunities to agricultural development

programs. As part of this framework, energy demands are assessed over a specific time period along with energy consumption patterns and energy supply resources.[21]

Ethiopia — Climate-Resilient Green Economy Strategy

The objectives of the Climate-Resilient Green Economy Strategy are to sustainably improve agricultural practices that increase crop yields; protect and reestablish forests; and introduce energy-efficient technologies in buildings, transportation and industry. To develop a climate-resilient green economy by the year 2025, several sectors have been identified for regional adaptation plans, including the agriculture sector.[22] The implementation of anaerobic digesters is one significant option for meeting the goals of the strategy to sustainably improve agricultural practices.

Finland — National Climate and Energy Strategy

The National Climate and Energy Strategy, which is implemented through several legislative acts, was first published in 2001 and has been updated several times. The goal of the strategy is the existence of a carbon-neutral society, made possible by following a long-term roadmap toward 2050. The strategy, which involves an increase in energy-efficiency and the use of renewable energy, makes implementing AD technology more attractive. Other goals of the strategy include obtaining energy supply security, maintaining competitive energy prices and fulfilling the EU common energy and climate goals.[23] The parliamentary committee on energy and climate started work on the roadmap in 2013 and has conducted extensive consultation with interest groups and citizens. This roadmap will be used to examine Finland's climate policy against other international climate policies and to assess the cost of transitioning Finland to a carbon-neutral society and reducing methane emissions by 80 to 95 percent (from levels emitted in 1990) by 2050.[24]

Vietnam — Biogas Program for the Animal Husbandry Sector of Vietnam

The "Biogas Program for the Animal Husbandry Sector of Vietnam" project is implemented by the Livestock Production Department under the Ministry of Agriculture and Rural Development in cooperation with the Netherlands Development Organization. Long-term project objectives are to improve the livelihood and quality of life of rural farmers in Vietnam by capitalizing on the economic and non-economic benefits of domestic biogas and the development of a commercially viable domestic biogas sector.[25]

[21] Food and Agriculture Organization of the United Nations. Chapter II – The framework: Methodology and design for integrated energy planning for sustainable agriculture and rural development. http://www.fao.org/docrep/t0363e/t0363e04.htm

[22] Federal Democratic Republic of Ethiopia. Ethiopia's Climate Resilient Green Economy Strategy. http://www.uncsd2012.org/content/documents/287CRGE%20Ethiopia%20Green%20Economy_Brochure.pdf

[23] European Commission. Assessment of climate change policies in the context of the European Semester – Country Report: Finland. 2013. http://ec.europa.eu/clima/policies/g-gas/progress/docs/fi_2013_en.pdf

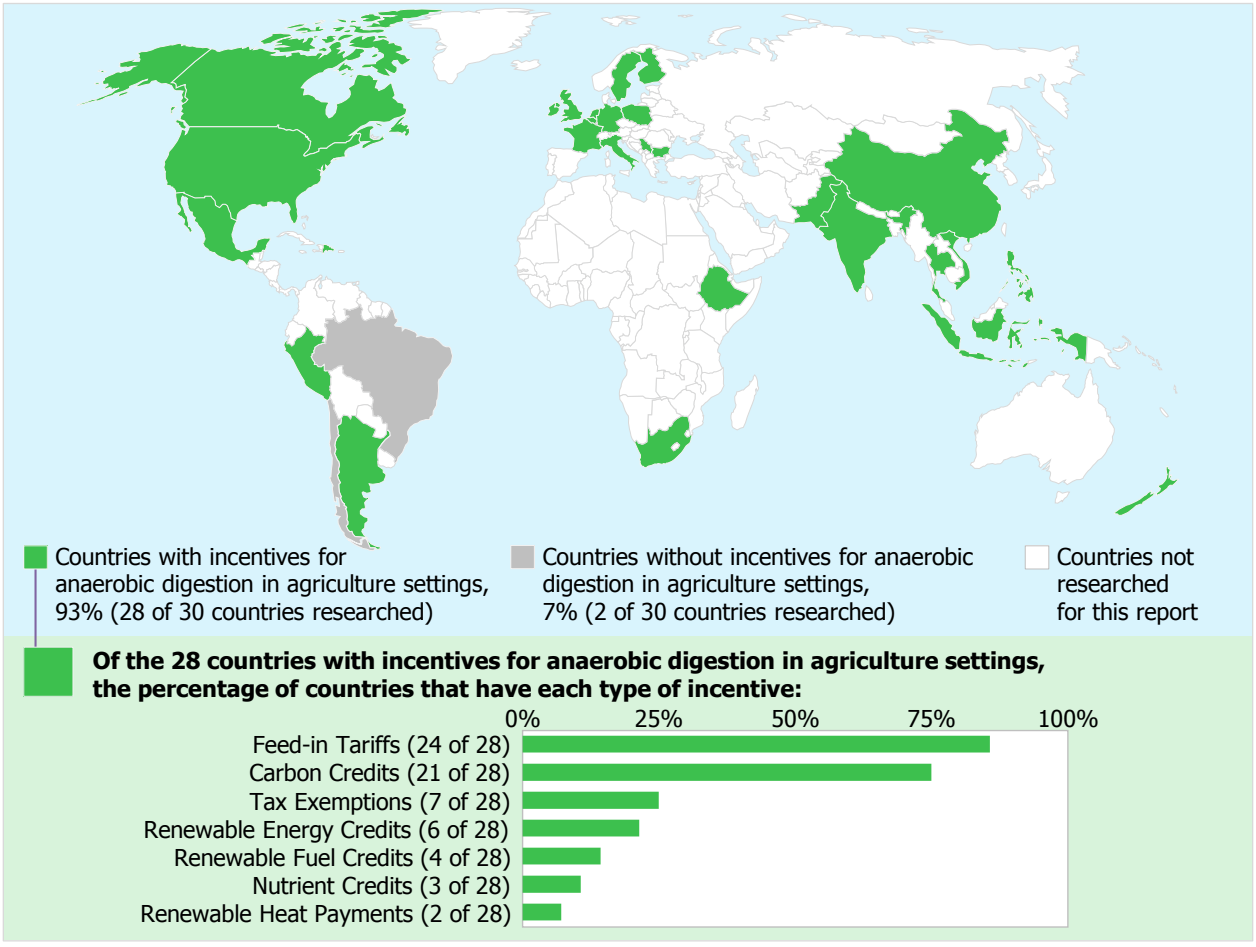
[24] Ministry of Employment and the Economy. Energy and Climate Roadmap 2050. https://www.tem.fi/en/current_issues/pending_projects/strategic_programmes_and_flagship_projects/energy_and_climate_roadmap_2050

[25] Biogas Program for the Animal Husbandry Sector in Vietnam. Project Overview. http://www.biogas.org.vn/english/Introduction.aspx

3 Incentives

The consideration and use of incentives play an important role in ensuring the success and viability of AD projects. Despite the well-documented benefits of anaerobic digestion, the reality is that these projects present financial challenges that must be addressed and resolved before a project will be implemented. For example, securing investment capital to design and build AD systems suited to the farmer's needs is a major challenge. Long-term operation and maintenance costs for AD systems; such as equipment, labor and training, often cannot be recouped easily through normal agricultural business practices. Additionally, financial institutions' unfamiliarity with AD technologies results in a perception that AD projects are high risk, capital cost intensive and low reward; thus, projects do not generate much investment interest compared with conventional energy-generating technologies (such as wind and solar). To encourage investment in AD, many countries offer incentives that increase the economic feasibility and attractiveness of AD systems by offsetting costs and generating revenue streams (see Exhibit 6). Some countries, such as India and Thailand, also provide government subsidies for the direct implementation of AD projects. Subsidies, usually offered as part of a broader incentives package, are not presented as a separate category of incentives in this report.

Exhibit 6. Countries that Use Incentives to Encourage Anaerobic Digestion



Successful incentive approaches include methods to assure premium value for the energy generated from biogas and schemes to engage market forces to leverage the environmental benefits of biogas. As discussed in the following pages, various incentives have been tried and are available to encourage implementation of anaerobic digestion projects across the world. As the breadth and scale of incentives relevant for AD are constantly evolving, it is important that stakeholders and governments stay informed about various types of incentives and identify those that might be more relevant and likely to succeed in their country. It is also important for stakeholders and policy influencers to consider a range of possible consequences of implementing incentives, such as changes in the way that arable land is used.

Feed-in Tariffs

The expansion in the number of AD projects worldwide can be directly attributed to the use of feed-in tariffs (FIT). Relevant for both small- and large-scale farms, FITs are commonly used and offered in both developed and developing countries to foster renewable energy projects. FITs require electric utilities to purchase, and in some cases pay a premium price for, the electricity generated by the AD system that is supplied to the grid. This approach assures project developers that the electricity produced by the AD system will generate revenue. FIT programs may also require utilities to establish long-term (15- to 20-year) contracts with AD system owners.

How do premium FITs encourage AD?

- FITs improve the financial viability of AD projects that generate electricity for sale to the grid.
- FITs increase investor confidence by creating more certainty in the value of the electricity produced.
- Fits ensure a return on the investments made to develop the AD system.

Table 2 presents a sample of FIT rates that are available in countries researched for this report. The FIT rates are presented in the standard currency of each country, as defined by the individual incentives, along with other eligibility criteria. Electricity rates and energy prices vary by location and may also fluctuate throughout the year, so some countries choose to negotiate or calculate FIT rates on a case-by-case (variable) basis rather than offer a fixed FIT rate. Where applicable, the type of FIT rate (fixed, variable, or calculated) is identified in the table.

Table 2. Sample of FIT Rates

Country	FIT Ranges
Argentina	0.015 Argentine Peso (ARS)/kWh (fixed, <30 MW)
Bulgaria	387 - 453 Bulgarian Lev (BGN)/MWh (variable)
Canada (Ontario)	21 - 26.5 cents/kWh (variable)
China	0.75 Chinese Yuan (CNY)/kWh (fixed)
France	EUR cents 4.34/kWh (fixed) EUR cents 8 - 13/kWh (variable)
Germany	EUR cents 23.73/kWh (up to 75 kWel)
Ireland	EUR 150/MWh [fixed, combined heat and power (CHP), ≤500 kW] EUR 130/MWh (fixed, CHP, >500 kW) EUR 110/MWh (fixed, non-CHP, ≤500 kW) EUR 100/MWh (fixed, non-CHP, >500 kW)

Country	FIT Ranges
Netherlands	EUR 0.09 - 0.15/kWh (calculated)
Serbia	EUR cents 12.31/kWh (fixed)
Thailand	0.50 Thai Baht (BHT)/kWh (fixed, <1 MW) 0.30 BHT/kWh (fixed, >1 MW)
United Kingdom	12.46 British pence (p)/kWh (fixed, ≤ 250 kW) 11.52 p/kWh (fixed, ≤500kW) 9.5 p/kWh (fixed, >500kW)
United States (various states[26])	10 - 54 cents/kWh (variable)

Note: Exchange rates for currencies fluctuate constantly. To compare FIT ranges amongst countries, use the current currency exchange rate for each country.

With a few exceptions, most of the countries researched for this report introduced FIT programs in the 2000s. Argentina implemented a FIT program in 1998, and the Philippines and Ethiopia initiated FITs more recently (since 2012). The widespread availability of FIT programs make it an effective instrument in encouraging AD development as investors consider this type of incentive to have a proven track-record of success.

Germany — Renewable Energy Sources Act (2000)

The Renewable Energy Act, which was last amended in 2014, provides a framework so that energy produced from renewable energy sources is guaranteed priority for feed in to the public grid. Payments are made within a 20-year fixed FIT. Additionally, there is a mandatory requirement for biogas plants to recover 60 percent of the heat generated by the system. Operators of the transmission system recoup system costs through a surcharge (EEG-Umlage) to consumers.[27]

Per this act, energy producers using AD systems are guaranteed that their energy will be fed into the grid. Incentives of this kind reduce the financial risk incurred by the owner of the AD system.

Finland — Act on Production Subsidy for Electricity Produced from Renewable Energy Sources (1396/2010)

The Act on Production Subsidy for Electricity Produced from Renewable Energy Sources introduced a FIT system for renewable energy power plants, including biogas, wind, forest chips and wood-based fuels. Administered by the Energy Authority, the system pays approved producers of renewable energy a FIT according to the difference between a 3-month spot market price and a set target price. Biogas power plants, including AD systems, qualify for an increased FIT, in the form of a standard heat premium, provided that they meet efficiency requirements and utilize the heat produced as energy.[28]

[26] U.S. Energy Information Administration. Feed-In Tariffs and similar programs. http://www.eia.gov/electricity/policies/provider_programs.cfm

[27] German Federal Ministry for Economic Affairs and Energy. The Renewable Energy Sources Act. http://www.erneuerbare-energien.de/EE/Navigation/DE/Gesetze/Das_EEG/das_eeg.html

[28] Ministry of Employment and the Economy. Feed-in tariff of renewable energy. https://www.tem.fi/en/energy/renewable_energy_sources/feed-in_tariff_of_renewable_energy

Credits for Carbon Reductions

One of the more popular types of incentives that relates to AD, carbon credits and carbon trading programs provide a mechanism for regulating greenhouse gas emissions, measured in units of carbon dioxide equivalents (CO_2e). A carbon credit represents one tonne of CO_2e that has been removed, avoided or sequestered from a defined baseline. In addition to the environmental benefits, each carbon credit is a commodity with market value. For example, an AD system can generate carbon credits by avoiding methane emissions and those carbon credits can be sold. Carbon trading programs provide the mechanism for exchanging carbon credits in a global marketplace of buyers and sellers. Carbon trading, also known as "cap-and-trade", establishes a control on the total emissions of regulated sources. First, a cap is set for total greenhouse emissions from regulated sources. Then, regulated entities can generate carbon credits directly or purchase carbon credits from the marketplace to meet their obligations for greenhouse gas emission reductions. This market has not been stable over the last decade. Therefore, project developers and investors often view carbon credits as a bonus incentive instead of factoring the credits into financial analyses as guaranteed revenue streams.

How do carbon credits encourage AD?

- AD systems may qualify for carbon credits by directly reducing methane emissions.
- Carbon credits may be earned by generating electricity from the biogas and avoiding the use of fossil fuels.
- Biogas producers or generators own the credits, which can be sold at market value to offset AD system costs.

Carbon credits are used more frequently for AD projects at agro-industrial facilities or large farms because prices of carbon credits are based on the amount of CO_2e that has been removed, avoided or sequestered from a defined baseline. Smaller farms may have little methane to offset in comparison with larger facilities. In addition, the monitoring requirements to verify carbon credits can be too expensive for smaller projects.

New Zealand — Emissions Trading Scheme

The Emissions Trading Scheme creates an incentive to reduce emissions by setting a price on GHGs and allows for the trading of New Zealand Units (NZUs), which are distributed by the Government. Those industries that produce GHG emissions during their operations are required to surrender one NZU per every two tonnes of CO_2e that they emit (excluding the forestry industry) in that reporting year. Those emitters who have not traded for NZUs may pay $25 per NZU. Additionally, industries that remove GHG, such as operations that plant or grow forests, earn NZUs that can then be sold to industries that emit.[29]

[29] New Zealand. About Obligations. http://www.climatechange.govt.nz/emissions-trading-scheme/obligations/index.html

EU member states — EU Emissions Trading System

The EU Emissions Trading System sets a cap and trade system that sets a limit on the total amount of emissions that can be released by industries including power plants, factories and airlines. Companies either receive or buy emission allowances and must surrender enough emission allowances to cover their annual emissions or pay fines. Those companies that reduce their emissions are allowed to sell their left-over allowances to other companies that need them or can save them. In addition to emissions allowances issued by the European Union, member states are allowed to purchase international credits.[30] Companies that implement AD systems and achieve GHG reductions can sell the extra allowances to other companies that have not met their annual emission limit.

Mexico — Mexican Carbon Platform (MEXICO2)

The Revenue Act of 2014 created a national tax for GHG emissions and provides taxpayers the option to participate in carbon markets and substitute payment of this tax by supporting specific mitigation projects.[31] Companies can substitute payment of the tax levy by purchasing carbon credits through the Mexican Carbon Platform (MEXICO2). These credits can be traded on the Mexican stock exchange. MEXICO2 allows organizations to offset their GHG emissions by trading carbon credits. One certificate is equal to the right to emit 1 tonne of carbon dioxide.[32] The purchase of the credits provides financing for national carbon projects that reduce carbon and GHG emissions. These carbon projects have included programs on jungle restoration, wind parks, sustainable agriculture, and methane management at coal mines and landfill projects.[33]

Tax Exemptions

AD systems and the biogas or electricity generated from the systems may qualify for tax exemptions. Tax exemptions provide valuable incentives by reducing the amount of taxes owed by those who qualify. Renewable energy tax exemptions are generally used to increase energy efficiency, reduce carbon emissions and encourage development of new technologies. They also may be tailored to support local needs for specific issues or community interests. This type of incentive is not as common as feed-in tariffs; as revealed during the investigation for this study, tax exemptions are offered in only 6 of the 30 countries.

How do tax exemptions encourage AD?

- They exempt AD systems from sales and use taxes to lower costs.
- Tax exemptions provide rebates for costs of electricity supplied from AD systems.
- AD systems do not increase the net property tax of the farm.

Dominican Republic — Renewable Energy Development Act

Under the Renewable Energy Development Act (Law 57-07), tax exemptions are available for equipment and accessories related to the installation of biodigesters.

[30] European Commission. The EU Emissions Trading System (EU ETS). http://ec.europa.eu/clima/policies/ets/index_en.htm

[31] Prontuario de Actualizacion Fiscal e-PAF. Publicada la Reforma Fiscal para 2014. http://www.e-paf.com/index.php/noticias-y-articulos/noticias-y-articulos-web/reforma-fiscal-2014/711-publicada-la-reforma-fiscal-para-2014

[32] Mexico Plataforma Mexicana de Carbono. http://www.mexico2.com.mx/

[33] El Economista. Carbon Platform Mexico2 breaks expectations. 2014. http://eleconomista.com.mx/mercados-estadisticas/2014/04/07/plataforma-carbono-mexico2-rompe-expectativas

Finland — Excise Tax Exemption

In Finland, biomethane is exempted from production and use excise taxes.[34]

United States — Production Tax Credit and Investment Tax Credit

The renewable electricity production tax credit provides a corporate tax credit of 1.1 cents/kWh for landfill gas, open-loop biomass, municipal solid waste resources, qualified hydropower and marine and hydrokinetic (150 kilowatt or larger) electricity. Electricity from wind, closed-loop biomass and geothermal resources receive 2.2 cents/kWh. Projects that receive other government grants or subsidies receive a discounted tax credit.[35] Closed-loop biomass includes organic plant material grown for the purpose of producing electricity. Open-loop biomass is characterized as agricultural livestock waste, cellulosic waste or lignin material and crop by-products or residues. The federal business energy investment tax credit (ITC) provides a tax credit equal to 30 percent of a commercial renewable energy project's qualifying costs. The ITC is a temporary incentive and can be received in addition to other subsidized energy funding per the American Recovery and Reinvestment Act.[36]

Philippines — Income Tax Holiday

Per Chapter VII of the Republic Act No. 9513, general incentives are available for renewable energy projects, including an exemption from national government income taxes for the first 7 years of commercial operation for registered renewable energy developers. An additional incentive allows renewable energy equipment and materials to be imported duty free for the first 10 years that the renewable energy developed holds certification. To qualify, an endorsement must be obtained from the Department of Energy before equipment and materials can be imported.[37] These tax exemptions reduce the financial burden of AD systems in the first years of operation, when costs are typically the greatest.

United Kingdom — Climate Change Levy (CCL)

Businesses associated with industrial, commercial, agricultural and public services must pay a Climate Change Levy (CCL) tax on the energy used with a goal to increase energy efficiency and reduce emissions. The electricity tax rate is established each year by HM Revenue & Customs. Businesses that purchase energy from renewable sources such as AD facilities are eligible for a CCL exemption via the issuance of Levy Exemption Certificates, which are provided to the end user from the energy supplier.[38]

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[34] Global Methane Initiative. Finland Biogas Update of the Global Methane Initiative (GMI) Tri-Subcommittee Meeting, Florianopolis Brazil. 2014. https://www.globalmethane.org/documents/news-item-438/08-Finland.pdf

[35] U.S. Environmental Protection Agency. Landfill Methane Outreach Program. Renewable Electricity Production Tax Credit. http://www.epa.gov/lmop/publications-tools/funding-guide/federal-resources/treasury.html#onea

[36] U.S. Department of Energy. Business Energy Investment Tax Credit (ITC). http://energy.gov/savings/business-energy-investment-tax-credit-itc

[37] Republic of the Philippines. Republic Act No. 9513. 2008. http://www2.doe.gov.ph/Laws%20and%20Issuances/RA%209513.pdf

[38] United Kingdom. HM Revenue & Customs. Climate Change Levy. http://www.hmrc.gov.uk/climate-change-levy/

Credits for Renewable Energy

In some countries, the non-power environmental attributes of renewable energy are monetized through the use of renewable energy credits. The credits function as a "currency" of the non-power benefits and provide a means to quantify and establish who owns the environmental benefits associated with the type of renewable energy. Of the 30 countries researched for this report, 6 offer renewable energy credit programs to help incentivize anaerobic digestion. Prices for renewable energy credits (RECs) depend on several factors and can include the year the power was generated, the technology used to generate the renewable energy, as well as where the energy was generated.[39] Each credit represents the non-power benefits associated with a fixed amount of energy generated (for example, a specified amount of avoided greenhouse gas emissions) and can be sold independently or bundled with the sale of the electricity. Each credit may have only one owner to ensure that the benefits are not counted multiple times. Governments, communities and individuals can purchase credits as a means to achieve net environmental benefits.

How do RECs encourage AD?

- RECs create revenue for AD project owners.
- AD-based energy use offsets non-renewable energy use.
- RECs increase investor confidence by creating value for electricity produced.

United Kingdom — Renewables Obligation

Renewable Obligation Certificates (ROC), commonly referred to as green certificates, were introduced in the United Kingdom in 2002 to provide incentives for implementation of large-scale renewable energy projects. Electricity suppliers are required to provide consumers with electricity that contains a certain percentage of power generated from renewable energy sources. The percentage is set every year and increases annually. Electricity suppliers that do not fulfill the year's annual obligation must pay a fine that is deposited into a fund that is later allocated to suppliers that met their certificate obligations. One ROC is issued for every one megawatt-hour of renewable energy generated in the United Kingdom. The price of ROCs is calculated by factoring in the source used to generate the renewable energy. Renewable energy generators can sell the ROCs to energy suppliers. The Renewables Obligation is set to close in 2037.[40]

United States — Renewable Energy Credits

Producers of renewable energy earn one REC per megawatt-hour of electricity they generate and feed into the electricity grid. Producers can sell the electricity they produce as well as the RECs they earn. Only energy bundled with a REC is considered renewable electricity. If the REC is sold separately from the physical electricity, the electricity is no longer considered renewable. To ensure that RECs are not "double sold," buyers are encouraged to verify and certify RECs.[41] Electricity produced from AD systems qualifies for RECs.

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[39] U.S. Department of Energy. Renewable Energy Certificates (RECs). http://apps3.eere.energy.gov/greenpower/markets/certificates.shtml?page=5

[40] United Kingdom. Department of Energy. The Renewables Obligation (RO). https://www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/the-renewables-obligation-ro

[41] U.S. Environmental Protection Agency. REC Tracking. http://www.epa.gov/greenpower/gpmarket/tracking.htm

Credits for Renewable Transportation Fuel

To encourage the displacement of traditional fossil fuels with renewable sources, some governments offer credits to providers of renewable transportation fuels. Under such a program, the government requires suppliers of transportation fuel to include a minimum amount of renewable fuel. More specifically, transportation fuel suppliers must show evidence that a specified percentage of the fuel is derived from renewable sources or pay a fee. Fuel sourced from AD systems that has been purified and blended with conventional transport fuels may qualify as a renewable transportation fuel source. Additionally, biogas produced from AD systems can be upgraded for use in compressed natural gas vehicles or liquid natural gas vehicles, which also may make it eligible for renewable transportation fuel credits. To date, renewable transport fuel credits are seldom used as incentives for AD systems. Belgium, Mexico, the United Kingdom and the United States are the only countries researched for this report that offer this type of incentive.

How do renewable fuel credits encourage AD?

- Renewable fuel credits increase demand for fuel produced from renewable and sustainable sources such as AD.

Belgium	Law of Blending Obligation

The Law of Blending Obligation requires companies that sell gasoline and diesel to blend in specified volumes of sustainable biofuel.[42]

United Kingdom	Renewable Transport Fuel Obligation Program

The Renewable Transport Fuel Obligation (RTFO) program mandates that a percentage of transportation fuel and fuel used in non-road mobile machinery must be derived from renewable and sustainable sources. The policy applies to biofuel and fossil fuel suppliers who annually supply at least 450,000 liters. Suppliers must register under the RTFO.[43]

United States	Renewable Identification Number System

The Renewable Identification Number (RIN) System was introduced in the Energy Policy Act of 2005's Renewable Fuel Standard (RFS) and modified by the Energy Independence and Security Act of 2007. These policies mandate that a certain percentage of fuels sold in the United States come from renewable energy sources. Developed by the U.S. Environmental Protection Agency (EPA) to ensure compliance, RINs are unique numeric codes associated with volumes of renewable fuel produced or imported. Every year gasoline producers, diesel producers and importers must meet their RFS mandated amounts by either earning RINs through fuel blending or purchasing RINs from other parties.[44]

[42] SRES Legal. Transport – Promotion in Belgium. http://www.res-legal.eu/search-by-country/belgium/tools-list/c/belgium/s/res-t/t/promotion/sum/108/lpid/107/page.pdf?out=pdf

[43] United Kingdom. Department of Transport. RTFO. https://www.gov.uk/renewable-transport-fuels-obligation

[44] U.S. Department of Agriculture. The Renewable Identification Number System and U.S. Biofuel Mandates. http://www.ers.usda.gov/media/138383/bio03.pdf

Credits for Nutrient Load Reduction

Countries that regulate discharges from large farms and industrial facilities can use nutrient trading programs to create incentives for utilizing anaerobic digestion. While not widespread, nutrient trading programs can be applied in countries with large farms and industrial facilities that regulate discharges. Currently, three countries reviewed for this report — Canada, Italy and the United States — offer these incentives. In the U.S., the incentive is used locally to address nutrient problems. Nutrient trading programs are similar to carbon trading programs, except that they apply to water quality rather than air emissions. Water quality regulations address nutrient loads (nitrogen, phosphorus and other chemicals) and typically specify two classes of pollution: point source and nonpoint source. Point sources include regulated facilities and other discrete pollution sources (for example, a pipe). Nonpoint sources are those that generate pollution from diffuse areas, such as runoff from agricultural lands.[45] Like a carbon credit, a nutrient credit represents a set amount of nutrients (such as nitrogen and phosphorous) that have been avoided or removed from the environment. Nutrient credits can be purchased, sold and exchanged among the regulated community to meet water quality thresholds.

How do nutrient credits encourage AD?

- AD systems may qualify for nutrient credits by reducing the amount of nutrients applied to fields (nonpoint sources).
- AD systems with supplemental nutrient management technologies may be capable of generating significant amounts of nutrient credits that can provide additional revenue for the farmer.

Digested manure is more easily processed by nutrient management systems that can yield nutrient credits. While the amount of nutrient reductions achieved depends on the technologies used, AD systems supplemented with nutrient processing may produce dramatic reductions in the amount of nutrients applied to fields (liquid effluent). Farmers with access to nutrient trading programs could develop custom AD systems incorporating nutrient processing technologies to maximize the amount of nutrient credits produced and the resulting revenue stream.

Canada – South Nation River Watershed	Total Phosphorus Management Program

The Total Phosphorus Management Program is a water quality trading program developed by South Nation Conservation in 2000. Under this program, new or expanding operators of wastewater lagoons who discharge effluent to the South Nation River watershed at peak flows are permitted to discharge phosphorus under the condition that the increased phosphorus load from their operation is offset by controlling loads from non-point sources, including agricultural runoff. The offset involves a fee paid by the discharger to South Nation Conservation, which is then used to fund the organization's Clean Water Program. The Clean Water Program works with landowners to implement best management practices and funds projects that prevent phosphorus discharge to the watershed, such as manure storage and control of runoff from barnyards.[46]

[45] U.S. Environmental Protection Agency. What is Nonpoint Source Pollution? http://water.epa.gov/polwaste/nps/whatis.cfm

[46] Environment Canada. Agents of Change – South Nation Conservation. https://www.ec.gc.ca/p2/default.asp?lang=En&n=21E379B9-1

United States	Chesapeake Bay Nutrient Credit Trading

The Chesapeake Bay, which drains an area greater than 64,000 square miles, exhibits elevated levels of nutrients, primarily nitrogen and phosphorus. On average, water within the bay contains greater than 250 million pounds of nitrogen and approximately 20 million pounds of phosphorus. Load limits have been set in partnership with states associated with the watershed to fulfill the requirements of the Clean Water Act and meet established total maximum daily loads. These load limits, which must be achieved by 2025, are the annual amounts of nutrients that can enter the bay from any one of its tributaries and include nitrogen, phosphorus and sediment. Nutrient trading has emerged as one way to meet nutrient load limits. Facilities that reduce their nutrient loading more than their reduction requirements are allowed to sell their excess reductions to facilities that have not fulfilled their load reduction requirements.[47]

Payments for Producing Renewable Heat

Currently, renewable heat incentives (RHI) are seldom used in the AD sector. Italy and the United Kingdom are the only countries highlighted in this report that offer this incentive. RHIs offer financial compensation to property owners for using renewable energy sources to provide heat for buildings rather than using fossil fuels or electricity from the grid. In the United Kingdom, property owners who install heating equipment that use renewable energy sources receive cash payments based on the amount of heat generated over a period of years. RHI schemes may be tailored to domestic or commercial-scale operations and specific requirements may be customized for producers who inject biogas into a natural gas distribution pipeline. Owners who install and use qualifying heat-generating equipment may recoup the equipment and installation costs over time through the RHI payments.

How do RHI schemes encourage AD?

- Incentives align to practical use of biogas on farms (heating).
- Payouts help to recoup equipment and installation costs over time.
- Applicable to small-scale and self-contained operations (such as a farm).

United Kingdom	Renewable Heat Incentive

The Renewable Heat Incentive is composed of two parts: domestic RHIs are available to homeowners, landlords, social landlords and self-builders; and non-domestic RHIs are available to industry, public sector organizations and businesses. RHI program participants are compensated for generating and using renewable energy sources to heat buildings. Under the domestic RHI program, tariffs are paid per every kilowatt-hour of heat generated and price varies by technology.[48] The RHI level for biomethane injection to the grid is set at 7.5 pence/kWh (guaranteed for 20 years). The program is currently being evaluated for tariff banding to avoid overcompensation of large projects.

Italy	Renewable Heat Payments

Incentives exist by means of a rotating fund for the installation of electrical and thermal efficient micro-cogeneration plants fed by biogas per Legislative Decree No. 20/2007.[49]

[47] Chesapeake Bay Commission. Nutrient Credit Trading for the Chesapeake Bay. 2012. http://www.chesbay.us/Publications/nutrient-trading-2012.pdf

[48] United Kingdom. Department of Energy & Climate Change. Renewable Heat Incentive (RHI). https://www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/renewable-heat-incentive-rhi

[49] Italy. National Renewable Energy Action Plan. 2010. http://ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_italy.zip

Summary of Incentives

The table below provides a summary of the incentives used by each country researched for this report.

Table 3. Types of Incentives Used by the Countries Researched for This Report

Country	Feed-in Tariffs	Carbon Credits	Tax Exemptions	Renewable Energy Credits	Renewable Fuel Credits	Nutrient Credits	Renewable Heat Payments
Argentina	✓	✓					
Belgium	✓	✓		✓	✓		
Bulgaria	✓	✓					
Canada	✓	✓		✓		✓	
China	✓	✓					
Dominican Republic	✓		✓				
Ethiopia	✓						
Finland	✓	✓	✓				
France	✓	✓					
Germany	✓	✓					
India	✓	✓	✓	✓			
Indonesia	✓						
Ireland	✓	✓					
Italy	✓	✓				✓	✓
Mexico		✓	✓	✓	✓		
Netherlands	✓	✓					
New Zealand		✓					
Pakistan	✓						
Peru	✓						
Philippines	✓	✓	✓				
Poland	✓	✓					
Serbia	✓						
South Africa	✓	✓					
Sweden		✓					
Thailand	✓						
United Kingdom	✓	✓	✓	✓	✓		✓
United States	✓	✓	✓	✓	✓	✓	
Vietnam		✓					

4 Other Drivers That Affect Anaerobic Digestion

In addition to establishing regulatory policies and offering financial incentives, many governments are exploring other approaches to boost interest in the benefits of anaerobic digestion and promote the development of more AD systems. Described below are two drivers that are positively affecting the anaerobic digestion market in the agriculture sector.

Organic Diversion from Landfills

There is growing interest in many countries, particularly in EU countries and the U.S., to establish mandatory requirements to divert organic materials from landfills. While the main objective for organics diversion often is to save landfill space for materials that cannot be recycled, this scenario encourages implementation of AD systems as a practical means to manage organic waste.

Organic waste diversion offers a tremendous opportunity for the agriculture industry to build more advanced AD systems that co-digest livestock wastes with other organic wastes from cities and municipalities. The increased availability of organic feedstocks can improve the financial viability of AD projects because more gas is produced and the concentration of methane in the gas may be increased. As organic waste diversion efforts in Europe, the U.S. and other countries are implemented, technical aspects of digester design and operation will be refined and additional lessons will be learned about how to structure permitting policies and regulations to ensure the safety and reliability of AD systems. Policy influencers and project developers alike can leverage these advancements and apply these lessons in the future.

EU member states	Landfill Directive (1991)
The Landfill Directive requires EU member states to limit the amount of biodegradable municipal waste that enters landfills to 35 percent of 1995 levels by the year 2016 for most countries. The main reason for the directive is to reduce greenhouse gas emissions. While the directive does not explicitly define how the organic waste will be treated after it is diverted, it does encourage municipalities to look for alternative means to manage biowaste. Anaerobic digestion not only processes the biowaste; it also reduces GHG emissions and produces useable biogas.[50]	

[50] European Commission. Biodegradable Waste. http://ec.europa.eu/environment/waste/compost/

United States — Diversion of Organic Waste from Landfills

Several states have enacted legislation requiring organic waste to be diverted from landfills:

- ✓ The **State of Massachusetts** requires organizations that dispose of at least one ton of organic waste a week to donate usable food and then transport remaining food waste to an AD facility or to composting and animal-feed operations.[51]
- ✓ Under the **State of Vermont's** Universal Recycling Law, all residents will be required to divert food scraps and yard waste from solid waste management facilities by 2020. It is anticipated that AD facilities will play a pivotal role in processing Vermont's organic waste in addition to waste generated from the state's agriculture sector.[52]
- ✓ In June 2014, the **State of Rhode Island** passed legislation that requires businesses that generate two or more tons of food waste a week to divert the waste to composting facilities, animal feeding operations or to waste-to-energy facilities such as anaerobic digesters.[53]
- ✓ In the **State of Connecticut**, businesses that generate a large amount of food scraps and are located within 20 miles of an accepting organics composting facility are required to source separate organic waste.[54]
- ✓ Most recently, the **State of California** passed legislation in September 2014 that requires businesses that generate more than 8 cubic yards a week of food scraps or yard trimmings to source separate the waste for recycling beginning in April 2016. Businesses that generate 4 cubic yards or more of organic waste a week are subject to the requirement starting in January 2017.[55]

Public-Private Partnerships

Public-private partnerships are proving to be a successful approach to address the impact of agro-industrial practices on water and soil quality. These partnerships promote collaboration among government representatives, the agriculture industry, the investor community, project developers and researchers on the leading edge of AD system design. Working in concert through partnerships, these organizations bring together resources and expertise to support various aspects of AD projects, including feasibility studies, governance, best practices and performance measurement. Such partnerships, often viewed positively by communities, are also helpful for facilitating public acceptance and demonstrating environmental responsibility.

GMI is an example of an effective public-private partnership with the primary goal of reducing global methane emissions. GMI products, tools and research are used to support AD projects in many countries and at many scales.

With respect to anaerobic digestion, public-private partnerships are more likely to involve agro-industrial facilities than livestock

[51] Massachusetts Department of Environmental Protection (MassDEP). Revised Guidance for Solid Waste Handling and Disposal Facilities on Compliance With MassDEP's Waste Bans: In Support of 310 CMR 19.000, Solid Waste Management Regulations, 310 CMR 19.017 Waste Bans. April 2014. http://www.mass.gov/eea/docs/dep/recycle/solid/a-thru-cd/wbguid.pdf

[52] Vermont Waste Management & Prevention Division. Act 148, Vermont's Universal Recycling Law. http://www.anr.state.vt.us/dec/wastediv/solid/act148.htm#info

[53] State of Rhode Island. Bill H7033. http://webserver.rilin.state.ri.us/BillText14/HouseText14/H7033.pdf

[54] State of Connecticut. Chapter 446d: Solid Waste Management. http://cga.ct.gov/2014/sup/chap_446d.htm#sec_22a-226e

[55] California Legislative Information. AB-1826 Solid Waste: organic waste. http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB1826

facilities. Agro-industrial facilities, which are often larger in size and funded with private sector money, are better-equipped to meet large public goals. However, advancements in AD projects and the lessons learned through their implementation may be useful for other kinds of facilities, including livestock farms with digesters, and to policy influencers in many countries.

Canada	Canadian Biomass Innovation Network

The Canadian Biomass Innovation Network (CBIN) is a partnership among federal researchers, policy makers, industry representatives, academia, community members and non-governmental organizations. The primary goal of the partnership is to sustainably develop the biomass economy by supporting research and development of new technologies in the bioenergy sector. The CBIN oversees the federally funded Science and Technology program, which focuses on activities related to sustainable feedstocks; biomass conversion; bioplexes and biorefineries; and governance, sustainability and performance measurement tools.[56]

European Union	Adoption of Quality Water Use in Agro-industry Sector

From 2011 through 2013, the Adoption of Quality Water Use in Agro-Industry Sector (AQUA) project was a public-private partnership involving research institutions, agro-industry companies and local governments that collaboratively fostered innovation within the agro-industry sector. Key objectives of the partnership were to reduce wastewater and conserve freshwater resources in a collaborative win-win approach where both the private sector and public sector contributed knowledge. In addition to establishing a group of supporters, several tools were made available, including a business network tool, compliance and regulatory reviews, information on industry best practices, a tool that provides water consumption analysis and a tool that provides economic evaluations of planned partnership efforts.[57]

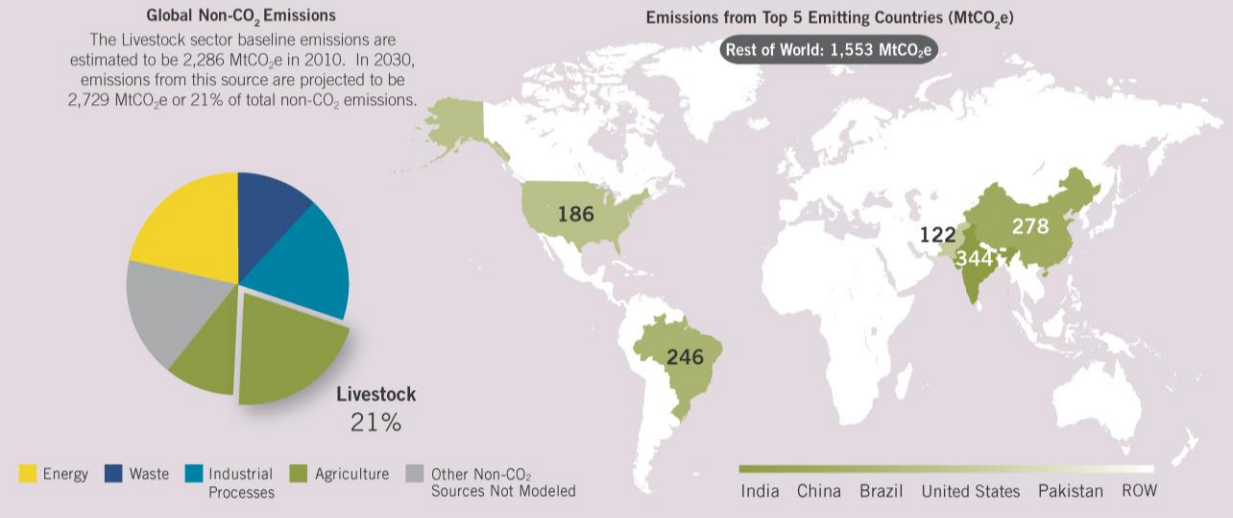
[56] Government of Canada. Canadian Biomass Innovation Network (CBIN). http://cbin.gc.ca/home

[57] AQUA Guidelines. http://www.life-aqua.eu/index.php/en

Conclusion: Increasing Awareness

With rising global awareness about the effects of climate change, governments are investing in economically feasible and sustainable solutions to reduce their country's GHG emissions. As shown in Exhibit 7, the U.S. EPA projects that livestock methane emissions will account for 21 percent of all global non-CO_2 emissions in 2030. Increasingly, many governments are turning to anaerobic digestion as a means to achieve GHG reductions in addition to producing renewable energy and employing effective nutrient management practices.

Exhibit 7. Projected Global Emissions from Livestock in 2030[58]



As shown throughout this report, anaerobic digestion is used at various scales globally to manage livestock waste, reduce GHG emissions and recover methane for use as a renewable energy source. In some countries small-scale digesters meet essential needs for controlling animal waste streams and generating fuel for cooking and power. In countries with a highly organized and regulated agriculture sector, AD provides a means to reduce air and water pollution while augmenting traditional energy resources with renewable ones. Anaerobic digestion is also helping communities consolidate feedstocks from multiple industry waste streams, such as food scraps, yard waste and municipal sewage sludge. Advancements in digester design, along with supportive regulations and incentives, continue to make AD a more feasible and practical solution for small- and large-scale waste management and environmental challenges.

Take Action

Research conducted for this report confirms that policies and incentives play a key role in determining the viability and scale of AD projects. In general, countries can enable farmers, project developers and investors to overcome barriers by specifically addressing anaerobic digestion in environmental and energy policies, and aligning incentives to be favorable for launching new AD

[58] U.S. Environmental Protection Agency. Global Mitigation of Non-CO_2 Greenhouse Gases: 2010 – 2030 Executive Summary. April 2014. EPA Report 430S14001. http://www.epa.gov/climatechange/EPAactivities/economics/nonco2mitigation.html

projects. The previous chapters of this report introduced readers to a wide variety of successful policies and incentives in 30 countries that are working to foster the development of AD systems. Table 4 aligns five primary goals to policies and incentives that have been effectively used in these countries. With this knowledge in hand, readers are better equipped to take action – that is, decide which policies and incentives are most useful for advancing the use of anaerobic digestion in their own countries.

What actions may readers take?

- Encourage national leaders to improve existing policies and incentives.
- Learn about AD technologies and trends.
- Explore the benefits of AD systems beyond waste management.
- Collaborate with potential partners who are interested in pursuing AD projects.
- Share lessons learned about AD projects and success stories.
- Visit the GMI website for country-specific summaries of AD policies and incentives.

Table 4. Policies and Incentives That Advance Anaerobic Digestion to Achieve Goals

	Examples of Successful Policies	Types of Incentives
	**Goal: Reduce Methane Emissions**	
	★ Require emitting facilities to obtain permits from a regulatory agency. ★ Set limits for the amount of pollutants that can be emitted. ★ Require facilities to use emission reductions plans.	★ Carbon credits ★ Renewable energy credits ★ Renewable heat payments ★ Renewable fuel credits
	**Goal: Operate Small-Scale Digesters to Provide Energy to Rural Farmers**	
	★ Provide direct financial assistance for construction and operational costs. ★ Conduct field inspections to ensure proper operations. ★ Establish training support for farmers.	★ Direct government financing ★ Tax exemptions
	**Goal: Implement Advanced AD Systems to Generate Renewable Energy**	
	★ Require energy providers to use a minimum amount of energy from renewable sources. ★ Qualify biogas from AD as renewable energy. ★ Establish targets for the amount of biofuels sold in the energy market.	★ Feed-in tariffs ★ Renewable energy credits ★ Renewable heat payments ★ Renewable fuel credits
	**Goal: Improve Agro-Industry Sustainability and Manage Organic Wastes**	
	★ Develop best management practices for planning feedstock collection, manure handling and storage. ★ Require diversion of organic materials from landfills. ★ Provide guidelines for odor control.	★ Feed-in tariffs ★ Renewable energy credits ★ Renewable fuel credits ★ Nutrient credits ★ Tax exemptions
	**Goal: Enhance Approaches to Nutrient Management**	
	★ Designate land at risk of pollution from agriculture ★ Require permits for dischargers ★ Require facilities to use nutrient management plans ★ Set limits for fertilizer use	★ Nutrient credits

www.globalmethane.org