Digestion in the USA

Business Analysis of Anaerobic Digestion in the USA

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INTRODUCTION

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Market conditions are looking increasingly favourable for the growth of the anaerobic digestion industry in the US. While this form of biogas production has historically been limited to agricultural and wastewater uses, it is growing in favour as a method of managing and extracting value from food wastes. The feasibility of anaerobic digestion projects varies state-to-state, however advances in technological application and favourable legislative developments are driving investment interest in the space.

Natural gas market in the US
Consumption of natural gas in the US climbed 11% from 2009 to 2012 to reach 25.5tn cubic feet, while overall production climbed 14% over the same period to 29.8tn cubic feet. Recently, supply and demand have begun to converge, though long-term demand is expected to remain strong, as use of natural gas becomes more popular across different industries, including transportation. Evidence of the commodity’s long-term promise can be seen in its popularity among investors. A handful of major players, including one of China’s largest private companies, have been ramping up investment in natural gas truck fuel infrastructure. This is anticipative of increased uptake due to the strong economic incentives for shifting from diesel to natural gas. Signs of an overall improvement in economic conditions and the cold winter have also supported buoyancy in the US natural gas market.

Resilient prices support strong outlook
Natural gas prices will always be unpredictable and this weighs on the risk profile of biogas project investments where the business model is to sell natural gas. However, official forecasts indicate that prices are likely to remain strong over the year ahead, and beyond, which should encourage anaerobic digestion developers. The Henry Hub average price of natural gas is anticipated to rise from $2.75 per MMBtu in 2012 to $3.41 MMBtu in 2013 and $3.63 per MMBtu in 2014. The average price in February 2013 was $3.33 per MMBtu.
The promise of biogas
The shale boom presented questions for developers of anaerobic digestion facilities. Estimates suggest that there is enough recoverable natural gas in the US to supply the country for more than a century. In order to produce natural gas of a high enough quality to be distributed in the pipeline or used in transportation, anaerobic digestion facilities must incorporate costly purification processes. While this has a negative effect, costs for these technologies will come down with time, and with infrastructure upgrades these routes to market will become more common.

Much of the drive to boost biogas production could come from government. Biogas satisfies clean energy regulations, specifically under the Renewable Fuel standard (RFS2) and the Low Carbon Fuel Standard (LCFS). More recently, the Biogas Investment Tax act has been introduced, which would provide a 30% investment tax credit (ITC) for qualifying biogas technologies. At present, biogas projects generating electricity are eligible for a production tax credit, but no such incentives are in place for producing biogas for other purposes, such as injecting natural gas in to the pipeline or fuelling vehicles. This bill would add biogas to renewables already receiving an equivalent credit, representing a potentially substantial boost for the proliferation of anaerobic digestion.

There are enormous untapped resources for biogas production in the US. If 50% of the food waste generated annually was anaerobically digested it would satisfy the electricity needs of 2.5 million homes for a year. The key challenge facing the industry at present is improving the economic model for development and investing in infrastructure to take full-advantage of this valuable resource.

Assembly Bill (AB) 1900
The assembly bill, signed in to law on September 27 2012, defines biomethane as a renewable fuel. The bill authorizes the California Energy Commission to establish a certification process for biogas energy content and purity. This will enable biogas producers to sell their fuel, rather than releasing it in to the atmosphere or burning it in flares. The economic and environmental benefits for California of this bill are significant. Jobs created by biogas producers will provide a
much-needed boost particularly in the hard-it areas where many projects are located, and reduced pollution from biogas will help support efforts to improve air quality. On introducing the bill, assemblyman Mike Gatto argued: ‘We can put Californians to work, clean our air, keep utility bills low, and we can stop the insanity of requiring existing producers of biogas to burn it while they use fossil fuels for electricity.’

Renewable energy market outlook
The EIA projects renewable energy consumption to rise by 2.6% in 2013, with a 3.2% fall in the consumption of hydropower offset by a 5.5% increase across other renewables. Although the shale-gas boom in the US lead to a perceived demotion of renewable energy as the primary solution to foreign energy dependence, continued growth in renewables is expected. As a share of US electricity generation, renewable energy is projected to constitute 15.2% by 2015, according to a 2011 report by Zpryme and ICP Strategies, ‘Renewable Energy and the Smart Grid.’ The same analysts anticipate annualized revenue growth of 7.7% between 2010 and 2015, rising from $60.2bn to $87.3bn.

The re-election of Obama, a staunch supporter of renewable energy and favoring an, ‘all of the above’ approach, was a major coup for the long-term growth of the US renewable energy market. Since Obama took office, renewable electricity generation has risen by nearly three quarters. Faced with opposition to government financial support for renewable energy projects (since the Solyndra saga) the president has been using executive authority to drive investment. For example, the administration is currently pushing for the securitization of renewable energy investment in order to attract private funding. In addition, the army and the navy have both announced ambitious renewable energy procurement targets.

The current state of Anaerobic Digestion in the US
There are three main manifestations of anaerobic digestion facilities in the US: wastewater treatment, municipal solid waste conversion and agricultural.

The EPA estimates that there are 192 anaerobic digester systems operating at commercial livestock farms in the United States (September 2012).

Number of operating digesters (September 2012)

Total farm-scale projects: 176, Total regional/centralized or multiple-farm projects: 16
There are a handful of anaerobic digestion facilities in the US focused on processing the organic portion of MSW. Supportive state policies in California mean that many of these are located in the state. Co-digestion is the most common way for food-wastes to be used as a feedstock. In these systems, additional organic wastes (e.g., food, fats, oils and grease) are added to agricultural or wastewater feedstocks. The high-energy content of food wastes boosts the biogas production of these facilities.

**East Bay Municipality Utility District – Oakland California**
The East Bay Municipality Utility District (EBMUD) processes both wastewater and food waste. In 2008, the facility digested 90 metric tons per day of food waste (22,000 tons per year). However, the plant’s commercial success is limited by air quality regulations, which mean only two of three generators can be operated. Excess biogas is flared and the digestate used as landfill cover.

**Zero Waste Energy – Monterey, California**
Zero Waste Energy recently opened the first organic waste to biogas facility to use SMARTFERM anaerobic digestion technology in the US. Located in Monterey California and developed for the Monterey Regional Waste Management District, the facility is capable of processing 5,000 tons of organic waste per year, generating 100kW of electricity or up to 3,200 BTU/Ton of Biogas with 58% - 60% Methane content.

**Harvest Power**
A venture-capital led start up now with significant investment from Waste Management, Harvest Power has facilities in Philadelphia, New Jersey.

According to the American Biogas Council there are 1,500 digesters at wastewater treatment plants (though only 250 use the biogas they produce and for the other 1,250 the biogas is flared). In California there are almost 140 wastewater treatment facilities that utilize anaerobic digesters.
and New York processing organic waste to form compost-based soil, mulch or fertilizer. In 2012, the company exceeded $100m in revenue. Harvest Power’s first energy plant in the US, which will use anaerobic digestion to produce biogas, is under construction in Orlando, Florida.

Food-waste anaerobic digestion facilities in the USA

<table>
<thead>
<tr>
<th>Owner</th>
<th>Location</th>
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<tr>
<td>Food-Waste Based Digesters</td>
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<tr>
<td>Gills Inions Project</td>
<td>California</td>
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<tr>
<td>Zero Waste Energy</td>
<td>San Jose, California</td>
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<td>Orange County Food Waste Pilot Plant</td>
<td>Orange County, California</td>
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<td>Monterey Zero Waste Pilot Plant</td>
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<td>Inland Empire-Environ</td>
<td>Chino, California</td>
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<td>University of Wisconsin</td>
<td>Oshkosh, Wisconsin</td>
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<tr>
<td>Co-digestion (waste water and food waste)</td>
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<tr>
<td>Gloversville and Johnston</td>
<td>Johnston, NY</td>
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<tr>
<td>Cottonwood Dairy</td>
<td>California</td>
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<td>East Bay Municipality</td>
<td>Oakland, California</td>
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<td>Sacramento County Co. Regional WWTP</td>
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<td>Central Marin Station</td>
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<td>Humboldt Country Waste Authority</td>
<td>California</td>
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<td>City of Riverside</td>
<td>Riverside California</td>
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Source: CalRecycle and ISLR

Strong pipeline for anaerobic digestion facilities
A number of projects are currently under proposal. For example, Humboldt Waste Management Authority (California) is considering a system with capacity of 10,000 tons per year, issuing an RFP in December of 2012. W2E Organic Power is due to begin operating a $23m, 58,000ton anaerobic digester in Columbia, South Carolina this year, where the state will purchase power generated at the plant. The same company is also planning a facility in Baton Rouge, Louisiana.

Commercial feasibility
The commercial feasibility of anaerobic digestion facilities depends on a number of factors. Overall return on investment varies depending on location, specific technology, local energy market, feedstock quality and consistency, tipping fees and government financial incentives.

Costs
While average anaerobic digestion project payback time is five to seven years, some feasibility studies estimate a longer period. A digester is a major investment, with an approximate initial cost of up to $600 per annual ton of capacity. Capital costs are high due equipment necessary, in particular feedstock preprocessing equipment, storage, digester, energy generator and hydrogen sulfide management. Operating costs are also substantial and depend heavily on individual project considerations. They range between $40 and $150 per ton of waste delivered. Financing is available, but costs are influenced by the perceived
risk of investing in food-waste digestion and the fact that the digester is not viewed as collateral by most lenders. Experienced project developers, proven technologies and loan guarantees will assist with attracting investors.

In order to minimize payback time to attract investment, all three revenue streams of an AD project should be maximized. These are: converting biogas to electricity for sale to the grid, charging tipping fees for processing organic waste and selling the digestate as bio-fertilizer.

**Fertilizer**
The co-product of anaerobic digestion, digestate, is comprised c.30% of biosolids and c.70% of liquids. Usually separated, liquids are used as fertilizer, while solids are either composted or used as animal bedding. It is difficult to identify a standardized value for digestate, though it is useful at farm-based facilities.

**Tipping fees**
Agreements can be reached with waste haulers to secure feedstock supply in many municipalities. Tipping fees range from $30 a ton to $50 nationally. A lower tipping fee (approximately by $10) than landfill is required in order to incentivize waste management companies to separate food waste from ordinary trash and deliver it to a separate anaerobic digestion facility. In some states, specific initiatives are in place to assist facility operators with sourcing adequate feedstock from food-waste sources (including restaurants). Such an initiative is in place in California where as of June 2012 the state was diverting 65% of waste from landfill, in pursuit of 75% by 2020.

**Power Purchase Agreements**
Negotiating an acceptable agreement with the local utility is central to the business model for an anaerobic digestion facility where the model is to sell power, though it can be tough. A 2008 survey of 64 California producers found that negotiating these contracts is the number one challenge they face. Agreements with utility companies generally take three forms: ‘buy all-sell all,’ ‘surplus sale,’ and ‘net metering.’ In the first case, facility operators will agree to sell all of the power produced at a set rate to the local utility, purchasing back the electricity needed to operate the plant. A key benefit of this type of agreement is that standby charges do not apply, however the energy needs of the system represent a project cost.

Under a surplus sale agreement, the energy created by the anaerobic digester is utilized on site, offsetting usage at retail rate. Electricity sold back to the utility is valued at hourly real time locational marginal price (LMP). This represents the wholesale price of electricity, which is typically half the retail rate. The rate fluctuates with demand, a key variable in project economics. Some utilities will also level administrative charges and standby charges will apply if the facility operator wishes to purchase electricity from the utility when the generator is down. According to the EPA, a digester engine-generator with good performance will be operational 90% of the time.

Under net metering systems, the operator of the facility pays the electricity utility for the net amount of electricity consumed. This allows facilities to offset electricity consumption costs by sending electricity to
the grid at any time and to use it as required. Net metering allows facility operators to cover on-site electricity demand as and when it occurs. As far as this does not exceed consumption, the electricity has full retail value, though most digesters produce more electricity than they can use.

**Feasibility for different AD users**

Feasibility for different anaerobic digestion users varies. Uptake of anaerobic digestion has been strong in the agricultural sector, where federal and states incentives have supported development. The government’s is seeking to increase the use of anaerobic digestion to 1,300 farms by 2020. The Rural Energy for America Program (REAP) offers grants of up to one quarter of project cost and loan guarantees of up to $25m. The Value-Added Producer Grant Program offers support with planning costs and working capital.

For wastewater projects, anaerobic digestion represents a highly economical way to process the organic solid waste. For this reason it is employed by the largest facilities located in highly populated areas. Co-digestion is becoming an increasingly popular system at these facilities, where the addition of food-waste makes for more effective biogas production.

MSW to energy anaerobic digestion facilities have not yet achieved the popularity of farm or wastewater projects. However, given that food composes between 14% and 18% of MSW, there is ample opportunity to capitalize more on this resource. Food waste has three times the methane production potential of biosolids. Fats, oils and greases and food waste are highly energy-rich. For this reason, many dairy farms that have digesters add local food scraps to the manure in their digesters to increase the amount of biogas produced.

For many companies in the food and beverage sector, anaerobic digestion is a viable way to manage the large amount of organic waste they generate. It has typically been employed to manage wastewater, though the high quantity of solid waste feedstock in a centralized location is suitable too for renewable energy projects. Partnerships with local municipalities can assist with the economics of such projects. As sustainability rises up the agenda for corporates, the attractiveness of anaerobic digestion is likely to increase.
The Anaerobic Digestion & Biogas Conference 2013

The biogas industry is growing fast. Federal tax policy is changing and state wide bills are being passed making it easier to inject the gas into the pipeline. All the signs point to a growth in adopting biogas for vehicle use and injecting into the pipeline. With this opportunity brings great financial incentive.

The conference will look at 5 key areas:

• **GET FINANCE FROM INVESTORS** by hearing case studies of successful investments which prove commercial viability & long term ROI to potential investors.

• **MAKE YOUR ANAEROBIC DIGESTER COMMERCIAL VIABLE** by maximizing the value from all revenue streams including fertiliser, gas and electricity. Plus reduce your tipping fee costs and exploit your energy credits.

• **UTILIZE THE FEEDSTOCKS FOR BIOGAS SUCCESS** by securing long-term feedstock agreements from sorted waste & drawing higher yields of product.

• **SET UP OPERATIONS & INFRASTRUCTURE** with big or small anaerobic digesters in the best locations to drive down costs and combat the NIMBY problem.

• **REDUCE COSTS IN REGULATIONS & PERMITTING** by learning what to include in your pitch to agencies, in order to get to market in good time.

Don’t delay, download the brochure for the Anaerobic Digestion & Biogas Conference today and find out how you can be part of the seismic shift shaking the market.