IPPTS Anaerobic Digestion Market Report 2017 – US and Europe

IPPTS Associates

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Introduction

In this document we provide our 2017 Anaerobic Digestion Market Report 2017, in which we cover prospects for the anaerobic digestion plant market in the US and Europe.

Our approach is to discuss the main topics which affect the anaerobic digestion (biogas) plant market currently, and provide our predicted outcomes for the year 2017.

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Background

Anaerobic digestion (AD) is a biological process in which biodegradable organic matter is broken down from complex to simple chemicals by bacteria and other microorganisms, while also creating solid and gaseous by-products. The biogas by-product consists of methane (CH4), carbon dioxide (CO2), and other trace amounts of gases, and can be upgraded by purification as a replacement for natural gas.

Anaerobic digestion of waste is the best (most environmentally beneficial) form of AD, because it solves two problems simultaneously, these being getting rid of a waste material, and answers the problem of where mankind can get the renewable energy that civilisation needs.

There are three main sources of organic waste all of which are suitable for anaerobic digestion:

1. Domestic and commercial waste collected from homes and businesses
2. Agricultural waste from farms and crop waste
3. Sewage.

General Outlook for 2017

Anaerobic digestion of solid organic waste such as bio-waste, sludge, cattle manure, energy crops and other biomasses, for bio-energy production is a widely applied technology used by a variety of industries. It is of increasing interest as it offers an opportunity to deal with some of the problems regarding the reduction of the amount of organic waste, while diminishing environmental impact and facilitating a sustainable development of the energy supply.

Anaerobic digestion is gaining more attention nowadays, both as a solution to environmental concerns and also as an energy resource for today's energy-demanding life style. It is a suitable technology to treat solid waste and waste water and it has been considered to provide a waste to energy technology with a huge potential for energy production if it is utilized on a global scale.

Acceptance in the Energy Marketplace

Acceptance of anaerobic digestion as a proven technology has been achieved over the last 10 years. It has now become fully accepted as a proven and an even preferred method for the intensive biodegradation phase of organic fractions derived from municipal solid waste. However, this is arguably not the biggest value of anaerobic digestion, which is the ecological value, apart of from producing energy.

Until recently, many national policies (including in Europe and some states in the US) were pushing the cultivation of energy crops, instead of the production of energy with waste through anaerobic digestion. The argument that the AD process was entirely socially beneficial and environmentally beneficial could not be made unequivocally while energy crop subsidies still existed.

In 2017 we are approaching the point in the US and Europe where such subsidies are being progressively removed. Soon only the older AD plants which have historically been grandfathered in on long-term subsidy deals, will still be getting any government assistance from such grants, until the currency of the grant payment expires.

Throughout Europe and the US in 2017 the likelihood of government subsidies improving for biogas plants is highly unlikely. The trend is for subsidy support to be reduced, despite the need for nations to comply with climate change agreeemt targets. Investors should assume that unless subsidy support is locally available, in general the climate for subsidising anaerobic digestion projects to meet renewable energy markets is unliley with few exceptions. Therefore, projects will need to be based on rigorous business plans which show adequate profitability without government financial support.

Incineration and Landfilling as A Competitor to Municipal Waste Anaerobic Digestion Projects in 2017

In many communities the buzz word for the aspiration of the community is zero waste to landfill. Compared with other energies, anaerobic digestion is probably the best technology, due to the fact that using it that allows a complete circular economy. An economy in which the materials used cycle perpetually through the products of that community, and are re-used hundreds and in some cases, many thousands of times.

Until 2000, the incineration of waste, with variable levels of recycling pre and post incineration, was the only real alternative to landfilling. In the 2000s in Europe and the UK, plus many other developed nations incinerations has been developed further and diverts waste away from landfills very successfully. Recycling has become more sophisticated, and the further processing of these wastes in some locations has become more sophisticated, with some novel technologies such as Mechanical Biological Treatment (MBT), gasification, and pyrolysis having been added at some municipal waste plants. However, incineration is still by far the most popular technology. Unfortunately, it destroys organic matter totally, and useful by-products otherwise produced by anaerobic digestion, such as bacteria-rich fertilisers, are lost.

Landfilling has to be stopped largely because landfilling of mixed household and commercial waste is highly polluting to watercourses and to groundwater. Unless the waste is put into sealed lined capped landfills. That's what is now being done at all landfills throughout the developed world. Within the modern lined and sealed landfills anaerobic digestion takes place, but very inefficiently. It is far better to separate organic waste from other forms of waste and digest the organic waste and make full use of the by-products of energy and fertilisers etc.

Disadvantages of Incineration as Drivers for AD Plant Developments in 2017

Incinerators are in fact very inefficient producers of energy because a huge amount of the energy of combustion never leaves the incineration plant, because it is absorbed by the necessary energy used to clean-up the flue gases. Many people would contest that incineration is truly “renewable energy” at all, and in Europe the regulatory authorities which approve these plants at planning stage are bringing in new rules. These rules state that an incinerator will only be considered as a renewable energy source if a set percentage of the waste hot water is used to heat local businesses and homes, within Combined Heat and Power (CHP) schemes. That means that future incinerator plants are unlikely to be approved in many cases unless the developer installs pipework to pump the otherwise wasted hot water to users who will use the heat beneficially. While AD plants are more efficient when combined with CHP included the same rules don’t normally apply.

In Europe the above disadvantages of incineration as drivers for AD plant developments in 2017 may have a marginal effect in moving service providers to opt for anaerobic digestion plants as part of MBT schemes in preference to building more incinerators.

Discussion of Anaerobic Digestion Benefits

Anaerobic digestion also has many advantages because of its comparatively low consumption of “sacrificial” energy used to operate the process itself, and low sludge production compared with aerobic water treatment the reduction in waste volume is not as great as for incineration, but that is more than compensated for by the production of bio-fertiliser, and valuable fibrous soil conditioners.

Nowadays, a range of anaerobic digestion technologies are converting livestock manure, municipal wastewater solids, food waste, high strength industrial wastewater and residuals, fats, oils and grease (FOG), and various other organic waste streams into biogas, 24 hours a day, 7 days a week. If you run a business which produces an organic waste, which is incurring at least $5,000 per month in electricity or natural gas expenses, anaerobic digestion might be economically feasible for your operation.

Anaerobic digestion processes can all be neatly categorised as either wet or dry anaerobic digestion. The wet anaerobic digestion process is applied to liquid waste streams that are conveyable by liquid pumping. The majority of these anaerobic digestion systems in operations are single stages, in a single stage (one stage), all of the biological reactions occur within a single reactor or holding tank. The rarer form of anaerobic digestion plant design is the two stage digestion process. Two stage digestion provides an easier to run bioreactor, but costs more to build. This is because the total volume of the two reactors is larger and the equipment needed is doubled for the two bioreactor tanks, instead of the one digester tank needed in the single stage designs.

The 2017 market for two stage digestion plants has been small in recent years, and this trend is expected to continue in 2017.

The Mesophilic and Thermophilic Biogas Plant Market and Trends in 2017

The majority of municipal anaerobic digesters in service operate in the mesophilic temperature range. However, in recent years thermophilic anaerobic digestion has been increasing in popularity due to its pathogen destruction capabilities and its ability to meet EPA's Class A pathogen requirements, per EPA's 503 regulations for biosolids land application. Similarly, in Europe pasteurisation is being achieved within mesophilic digesters to comply with the Animal By-Products regulations. Thermophilic anaerobic digestion plants with their higher operating temperatures tend to need smaller reactor tanks for a given throughput of feedstock, as well and as time goes on it is likely that a larger percentage of AD plants will operate in the hotter thermophilic temperature range.


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Biogas, the product of anaerobic digestion process is a clean and renewable form of energy which can be a substitute for conventional sources of energy which are causing ecological-environmental problems and at the same time depleting the world's resources in fossil fuels at rapid rate. The production of biogas through anaerobic digestion offers significant advantages over other forms of bioenergy production. Major progress has been made in all areas of waste management in the last 15 years or so, but the introduction of anaerobic digestion into the treatment of municipal solid waste using almost wholly mesophilic processes is one of the most successful and innovative technology developments observed during the last two decades in the waste management field.

2017 is expected to see a continuation of this trend, but with public investment in Europe generally suppressed by poor performance of national economies and continued weakness in the Euro, prospects for large new municipal waste anaerobic digestion plant projects will be limited.

How will the Big-Picture for Anaerobic Digestion be Developed Through 2017?

There are studies that show that the anaerobic digestion of organic waste could be developed to the point where there would be far more AD plants than exist at the moment. Many communities have been composting wastes for a long while, but it is possible that the AD process would be a better and more sustainable option for these wastes. For example, this is no more starkly evident that for food waste disposal, and in many communities better recycling alternatives to composting food waste should be explored.

The main obstacle to implementing anaerobic digestion systems globally is that it constructing biogas plants is a major capital investment. This would not matter if AD plants were more profitable. Most AD plants take 6 to 7 years to pay back the investment, unless governments subsidise them. The future of larger scale biogas plant development globally will be to develop anaerobic digestion technology further, and by doing that make each AD plant significantly more productive. The aim is to reduce payback times to 3 to 4 years, without any government subsidies

A 2009 study by Keske found that minimizing anaerobic digestion production costs (e.g. maintenance/repairs, and labour) and boosting energy production showed the greatest impact on net income from an anaerobic digester. Gas production is an indicator of how well the anaerobic digestion process is performing. More and more companies are developing products which improve the efficiency of biogas plants, and AD plant designers are incorporating the best of these into their designs, so that year on year, anaerobic digestion plants are able to operate better.

The 2017 EU market for anaerobic digestion plants is likely to remain depresssed, and this trend is expected to continue throughout 2017. There may be isolated highlights in some nations which through EU promoted initiatives will be expected to have some limited success in encouraging biogas plant development in nations such as Spain and France which are aware that they have fallen behind many other EU nations in the number of AD plants commissioned in the last 10 years or so.

Self Motivated Farm Businesses May Form a Trend Toward New Biogas Plants in 2017

However, in many areas of agriculture and farming profitability of the biogas plant once installed, may be of secondary consideration, because what matters to a farm business is the overall farm income, and the resilience of the farm against bad weather seasons and fluctuating food market prices. Biogas plants can be an enormous help there, and in so many ways it is impossible to describe them all here.

For example, many dairy farms, poultry and swine operations should strongly consider anaerobic digestion systems, as without them their operations appear vulnerable to lawsuits from water pollution by the farm rainwater run-off, without them.

There are some indications that farm business uptake for AD plants may rise in 2017 both in the US and Europe, due to a greater awareness of the large synergistic benefits an AD plant provides for many farms.

The Utilisation of Crop Residues as a Driver for Raised and Plant Development in 2017

Crop residues are mostly left to rot on the ground after harvesting, but these certainly deserve more research attention for being used as a feedstock for co-digestion with farm manures. A wide range of biomass types can be used as substrate (feedstock) for the production of biogas from anaerobic digestion process. It is because of its large unexploited benefits of biogas production via anaerobic digestion, that under President Obama's term in office in the United states, a roadmap was put together to build over 10,000 anaerobic digestion plants on farms throughout America.

And, it is not only in the agricultural community that there is room for optimism for increased uptake of the AD process in the US. In recent years, due to increased interest in renewable energy and concerns about greenhouse gas emissions, more anaerobic digestion systems are being built in the United States, for food processing businesses, hotels and colleges. In fact, a number of US agricultural colleges are building and operating their own AD plants in the US, as both viable sources of energy to power and heat college buildings, and as a way to demonstrate the technology to the next generation of farmers.

It is anticipated that the US may have a good year in 2017 for self motivated farm business in the dairy sector on large farms, building new AD plants.

Challenges for Anaerobic Digestion Projects in 2017

But, it is not all good news for anaerobic digestion. It is important to recognise that many variables can affect the economic feasibility of anaerobic digestion projects.

Developing anaerobic digestion plants can be risky for businesses that don't have a baseline feedstock supply available from their own business operations. For example, developing solely food waste AD plants speculatively may appear attractive where government policy is driving local authorities to collect their household food waste, resulting in high gate fees being offered by those LAs to AD plant operators willing to accept this waste.

However, what we've learned in the past few years is that the challenges which arise when, during household waste collection the result is co-mingled food waste and yard waste, and food soiled paper, that can cause substantial problems for anaerobic digestion plant operators. New technology to remove grit, and pumps capable of handling widely varying feed material viscosities, are now coming onto the market, but some risk to operation from some food wastes does still remain.

Also, the promoters of new AD plants need to very carefully consider the effect of possible saturation of the market. While waste food is considered at the moment to be a "waste", and the AD plant operator can command high gate fees, the market is not large and a few new players in the market, such as new AD plants in a region might possibly result in a shortage of AD plant feedstock (e.g. waste food). Gate fees can plummet. Possibly, the AD plant operator may even need to start paying for the organic waste needed to run the process, and that would possibly put some AD plants out of operation.

The key to successful digester operation is maintaining consistent operating conditions, such as temperature, and digester vessel retention times. The organisms on which anaerobic digestion process relies are quite slow growing. So, feedstocks sources which vary widely in quantity and quality/ calorific value can cause operational problems.

Opportunities will be Biggest for the Early Adopters of the AD process in EU and US in 2017

But, these concerns must be considered small when one considers the growing global concerns about the increasing amount of waste, global warming and a reliance on fossil fuels as the main energy source. Anaerobic digestion is a comparatively young discipline, and the recent rise in investment in new AD plants has stimulated research on the anaerobic digestion process and its complexities. Those that have got into this industry so far must, even now, still be considered to be early adopters of what is effectively a new technology. As such, there must be many discoveries as yet unmade, which in the future will continue to feed into the process technology, bringing big technological advances, raising profitability.

Even though continued progress has been made with other alternative treatment technologies (gasification, pyrolysis, plasma, biological drying, etc.), these technologies have by far not seen the same widespread implementation that anaerobic digestion has been able to achieve.

Anaerobic Digestion Massive Room for Growth for an Industry Still in its Infancy in 2017

It should be remembered that, for example, the US still has less than a thousand AD plants, when the potential for large farms to build these plants and run them profitably, even at existing rates of return using current technology, is way below the potential. This material is only actually being digested on very small number of the possible 10,000 plus suitably large farms. The ninety percent of remaining manure is just being thrown to the fields without being digested. So, the ecological potential of anaerobic digestion is still massively undeveloped, even for biogas production from dairy and poultry/ pig manure alone. That's not even considering the potential when crop-waste is considered, and that resource has not been touched upon in the US, and is hardly a significant proportion of AD feeds elsewhere either.

Limitation of carbon dioxide and other emission through emission regulations, carbon taxes and subsides on biomass energy is making anaerobic digestion a more attractive and competitive technology for waste management, with each year that passes.

Conclusions

Europe, specifically Germany, is leading the development and applications of anaerobic digestion technology, and that lead is not likely to be challenged during 2017.

The US should prove to be the sleeping giant in Anaerobic Digestion Plant development, but in view of the uncertainties of support for all things "green" under the new President Trump, whether many US AD projects will actually start construction during 2017 is very uncertain.

Overall there are massive opportunities throughout Europe for the further larger scale development of Anaerobic Digestion technology.

Join with us in promoting this vision.

We would be delighted to receive your feedback and comments here.

End – Note:

This report has been prepared by IPPTS Associates, Shrewsbury, Shropshire, UK (Date: February 2017)

We hope that you found this report useful. We would appreciate feedback from our readers, and if possible and appropriate, your support for our future report production, in the form of sharing your experience with others to raise the circulation of this report.

Please visit Steve Last's IPPTS Anaerobic Digestion Community website at:

HTTP://Anaerobic-Digestion.com

Email address: info@anaerobic-digestion.com

Steve provides a full environmental engineering and waste management consultancy service. Click the following link to view his environmental compliance consultancy website at www.IPPTSassociates.co.uk