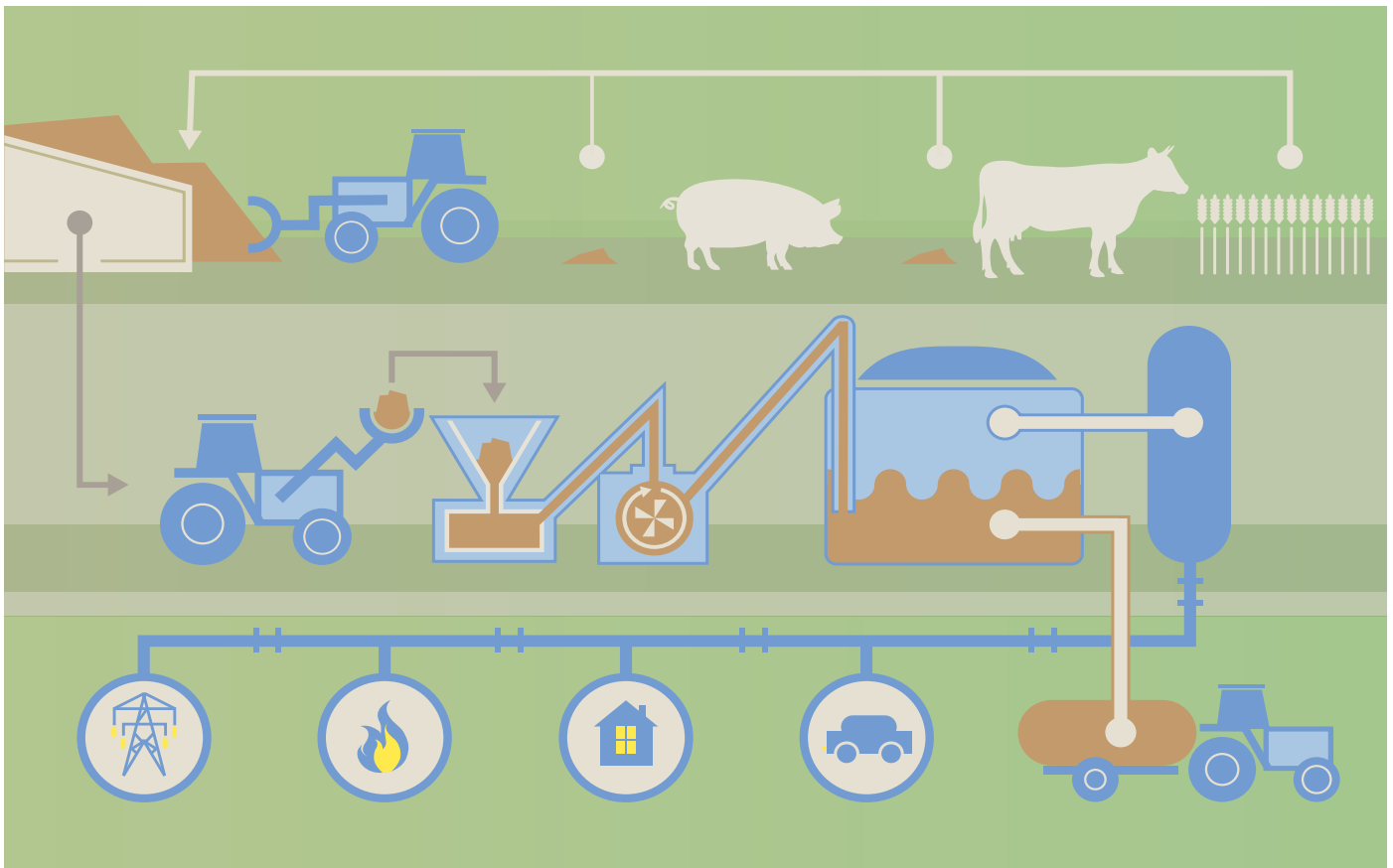


Spotlight | 2018

Farm Anaerobic Digestion: Growth and Performance



Summary Output improving, but majority not at target output

- Significant growth in the UK AD market, with over 255 farm AD CHP plants registering over the past 10 years
- Steady improvement in capacity factor over past 10 years with the average in 2017 being 86.3%, up from 29% in 2008
- On average, in the first year of operation, farm-fed AD plants achieve 54% capacity factor, in the second year 69% and 75% in the third year of operation
- 53% of plants are not achieving a capacity factor of over 90%, after three years of operation
- Smaller plants are using more heat for RHI eligible purposes than larger plants, the small (sub 200kW), and large (600kW plus) biogas tariffs achieving 47% and 25% heat use respectively

Farm AD Performance

Outputs are improving, but the majority are still below their potential

Anaerobic Digestion is a process that refers to the breakdown of organic matter in the absence of oxygen. Anaerobic Digesters use this process in order to collect the methane gas produced. The methane can be used for fuel in transport, injected into the mains gas system or combusted in a combined heat and power (CHP) unit to produce electricity and heat.

The CHP use is the focus of this publication. It provides an insight into the growth of the farm AD CHP sector and looks at the performance of AD plants over the past decade. While electricity forms the main source of income for CHP projects, the heat generated provides an important additional income.

Many on farm AD projects were driven by innovative farmers who identified an opportunity to integrate renewable energy into their farming operations. However, much of the early growth was funded on the back of beneficial tax relief schemes such as the Enterprise Investment Scheme (EIS), Venture Capital Trusts (VCT) and SEIS (Seed Enterprise Investment Scheme) before eligibility was withdrawn in 2015.

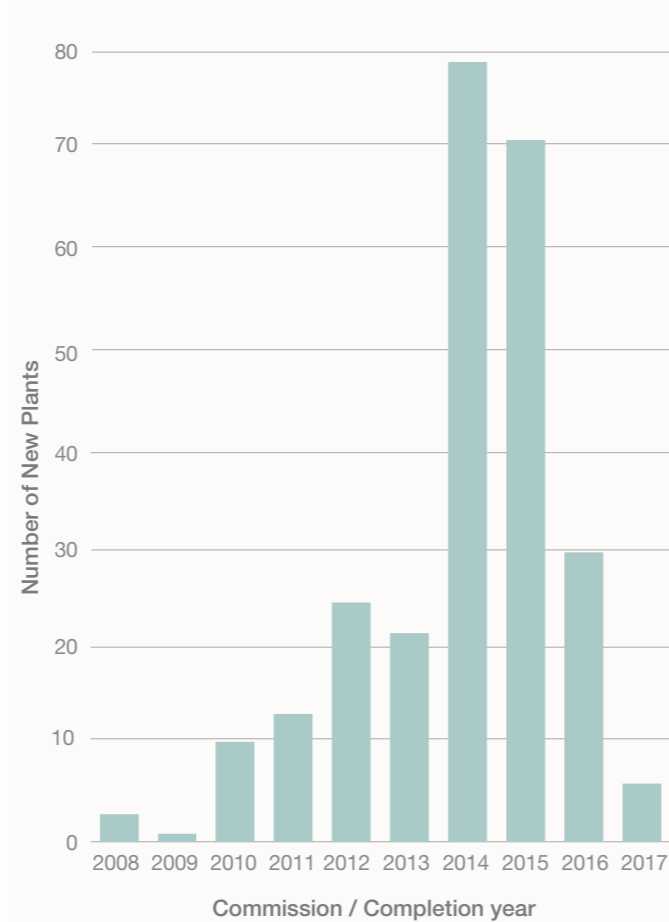
Our research shows the growth in the AD sector since 2008 (Figure 1). The introduction of the Feed-in-Tariff (FIT), and banded NIRO in Northern Ireland, and latterly the Renewable Heat Incentive (RHI) had a significant impact on the AD industry. They made the development of smaller and medium scale plants possible and opened up the sector to a new group of developers which includes farmers. The majority of growth in farm AD occurred in 2014 and 2015 following AD over 200kWth being made eligible for Non-Domestic RHI in December 2013.

Electrical Output

Our research shows a steady improvement in the output of AD plants. Starting from a low position of below 30%, the average capacity factor steadily improves to over 85% in 2017.

The improvement in performance has been driven by plants maturing from the initial start-up phase, a greater understanding of the management required for optimal plant operation including feedstock strategies. Some of the early plants were only able to accept a narrow spectrum of feedstocks and as such their performance was limited without further investment.

FIGURE 1 Growth of farm-fed AD since 2008



Source: ADBA map registered with OFGEM (as at February 2018)

FIGURE 2 Farm AD timeline

2008	October: FITs announced
2009	Banding of Renewable Obligation introduced
2010	April: FITs takes effect May: Coalition government formed
2011	November: RHI is launched
2012	February: FITs comprehensive review 2B announced December: Review 2B took effect – introduced preliminary accreditation and degression
2013	December: Energy Act receives Royal Assent and biogas systems over 200kW are eligible for RHI support
2015	February: Key changes to the biomethane tariff May: Conservative government elected April: EIS, SEIS, and VCT schemes banned from investing in renewables August: FIT consultation launched October: RHI sustainability requirements introduced December: New FIT rates announced
2018	May: New RHI regulations introduced which included uplifted Biogas and Biomethane tariffs

Average capacity factor by year from commissioning

This research takes the average capacity factor of farm-fed plants commissioned since 2010. The results show the capacity factors these plants achieved in year 1, 2, 3 and over three years after commissioning.

When considering AD we would expect the first year of operation to be significantly below the target output as the plant needs to 'ramp up' its biological activity. Figure 4 shows that on average it actually takes two years for stable output to be achieved. Individual plants can typically ramp up in three months or less, but across the sector a number of plants are taking significantly longer to consistently generate at a stable output.

Do the average capacity factors shown in Figures 3 and 4 represent what might be expected for most AD plants, or is there a variation between high performers and low performers? In order to answer this we've sorted the plants into capacity bands to identify the spread of performance.

Figure 5 shows that there is clearly a wider variation in AD plants' performance. A significant number of plants are achieving 90% plus output, but the majority (53%) are performing below the assumed target output of 90%.

The 100-500kW size band has the highest number of plants achieving a capacity factor of over 90%. This is possibly a reflection of the difficulties for larger plants in sourcing enough feedstock, and that larger plants are more likely to have a wider mix of feedstocks, which when switching from one feedstock to another can cause dips in gas output.

Heat output

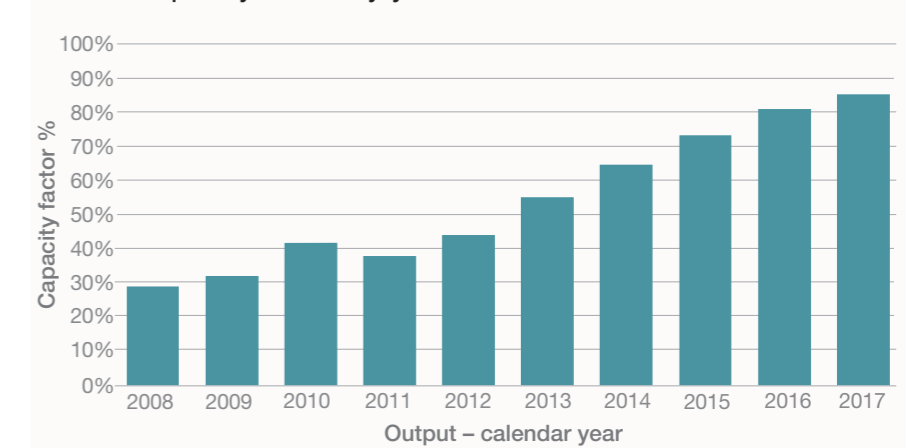
While electricity forms the primary income for AD plants with CHP units, they actually produce more heat than electricity. It is therefore important to identify a use for the heat in order to optimise the plant's income.

RHI is only paid for heat uses the government deems as eligible, for instance this could be heating a building, glasshouses, or drying floors (for plants commissioned after the 22nd May 2018 the drying of woodchip or digestate is not considered eligible).

Figure 6 shows how much heat is claimed for RHI payments as a percentage of thermal capacity. The plants have been separated into bands according to the RHI tariff they have been accredited to.

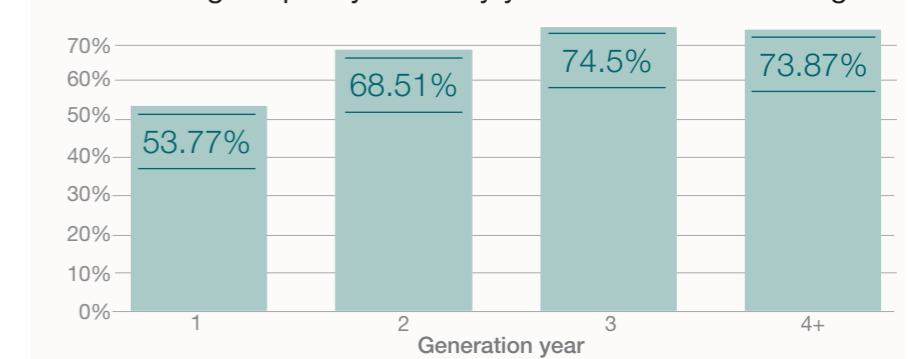
The figures show that smaller schemes are utilising the greatest proportion of heat produced, whereas larger schemes seem to be struggling to find uses for the heat. This is likely to be a reflection of the lower value of the larger tariff bands under the RHI, making the heat a less valuable income stream as well as the practical difficulties and cost implications in utilising a large and constant heat supply. ■

FIGURE 3 Capacity factor by year



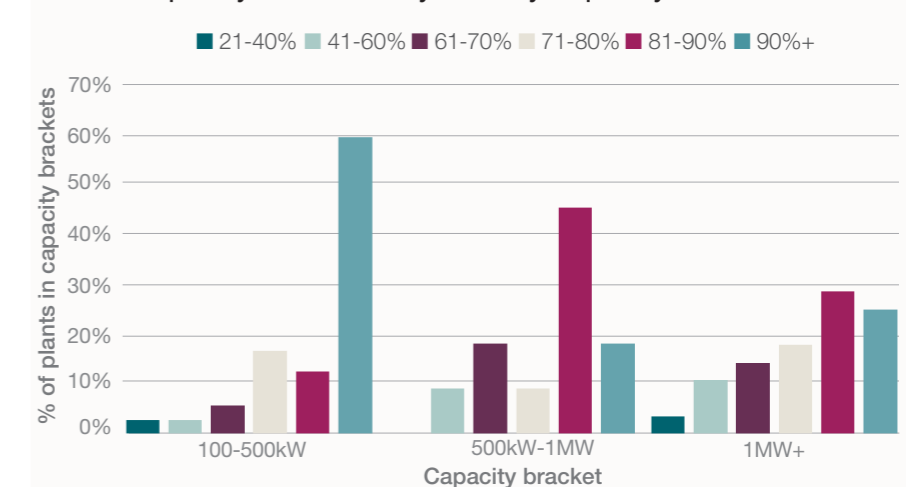
Source: OFGEM reporting stations matched with ADBA Map (Farm-fed, REGO)

FIGURE 4 Average capacity factor by year from commissioning



Source: OFGEM reporting stations matched with ADBA map

FIGURE 5 Capacity factor after year 3 by capacity band



Source: OFGEM reporting stations matched with ADBA map (farm-fed, REGO)

FIGURE 6 Heat use as a % of thermal capacity

RHI tariff band	Capacities	Average eligible heat use
Small biogas	Less than 200 kWth	46.7%
Medium biogas	200 kWth and above & less than 600 kWth	40.3%
Large biogas	600 kWth and above	25.4%

Source: Savills Research and OFGEM

Conclusion

AD plants tend to be built with a target capacity factor of over 90%, something over half of the sample are not achieving. However, the average capacity factor across all schemes for 2017 was 86% and has been steadily rising since 2011, suggesting that AD plants will, on average, eventually achieve their target output. The 100-500kW bracket has the strongest performance record in electrical output and in utilising heat the most effectively for RHI eligible purposes.

AD, more so than nearly all other renewable projects, requires a wide range of skills, a detailed understanding of the processes involved and daily management in order to achieve the best performance. Even those businesses with a high capacity factor are likely to be able to improve the operational and financial performance of their plants.

Do you know your performance?

Ways to improve performance include:

- Feedstock reviews including consistency, suitability of crops, pre-treatments, cost and supply risk.
- Operational reviews including cost, response times, performance guarantees, staff training and biology health.
- Additional income including maximising generation, heat uses, private wire arrangements, digestate value and CO2 scrubbing.

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- Ongoing planning condition discharge and compliance
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- Feedstock sourcing and management
- Contract negotiations

Glossary

AD Anaerobic digestion	kWh Kilowatt hour (a unit of energy)
CHP Combined heat and power	FIT Feed-in Tariff
CF Capacity factor (the actual generation divided by the theoretical maximum generation)	RHI Renewable Heat Incentive
kW Kilowatt (a unit of power)	REGO Renewable Energy Guarantee of Origin
	RO Renewable Obligation

Methodology and sources

Plants

Identified as farm-fed AD plants, registered with OFGEM REGO scheme

ADBA: <http://adbioresources.org/about-ad/ad-map>

REF: <http://www.ref.org.uk/>

NNFCC AD Portal: <http://www.biogas-info.co.uk/>

OFGEM: <https://www.ofgem.gov.uk/>

Output data

Plants that reported 12 months in each generation period, where capacity factor <=110%

OFGEM: <https://www.ofgem.gov.uk/>

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