Title: Periodic Review of the Feed-in Tariffs 2015 Phase 2: Anaerobic Digestion and Micro Combined Heat and Power	**Impact Assessment (IA)**
IA No: BEIS003(F)-17-CE	**Date:** 8 February 2017
RPC Reference No: N/A	**Stage:** Final
Lead department or agency: Department for Business, Energy and Industrial Strategy	**Source of intervention:** Domestic
	Type of measure: Secondary legislation
Other departments or agencies: N/A	**Contact for enquiries:** admchpreview@beis.gov.uk

Summary: Intervention and Options

RPC Opinion: Not applicable

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANDCB in 2014 prices)	**One-In, Three-Out**	**Business Impact Target Status**
£m	£m	£m	N/A	QRP/NQRP

What is the problem under consideration? Why is government intervention necessary?

The European Commission's State Aid approval for Feed-in Tariffs (FITs) places an obligation on Government to review the scheme every three years. The previous review that took place in 2015 did not cover anaerobic digestion (AD) and micro combined heat and power (mCHP), which were addressed in a subsequent consultation in 2016. The purpose of this review is to ensure that support is still at appropriate levels. This stage of the review also ensures micro-CHP spending is managed within the £100m budget assigned for new FITs installations under the Levy Control Framework (LCF).

What are the policy objectives and the intended effects?

The policy objectives for AD are: to improve value for money; to control spending under the FITs scheme; to limit its direct impact on consumer bills; and to improve sustainability and achieve additional greenhouse gas emissions savings. For mCHP, the objective is to mitigate the risk of high spending by including this technology in the £100m budget for new installations under FITs, introducing six-monthly deployment caps and contingent degression.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Option 1: Do nothing.

Option 2 (preferred): Revise AD generation tariffs across all bands based on the latest data, and implement default degression. Introduce sustainability criteria and feedstock restrictions for new AD plants. Implement deployment caps and contingent degression for micro-CHP. This will help Government comply with its State aid obligation to avoid overcompensation to generators, while also ensuring spending on FITs and its impact on consumer bills remain controlled. By introducing restrictions on AD feedstocks, this Option also incentivises more sustainable practices and helps achieve greenhouse gas emission savings.

Will the policy be reviewed? It will not be reviewed. **If applicable, set review date:** Month/Year

Does implementation go beyond minimum EU requirements?		N/A		
Are any of these organisations in scope?	**Micro** Yes	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)		**Traded:**	**Non-traded:**	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister: 7.2.17 Date:

Summary: Analysis & Evidence

Policy Option 2

Description: Introduce new generation tariffs, default degression and feedstock restrictions for AD from April 2017.

FULL ECONOMIC ASSESSMENT

Price Base Year 2017	PV Base Year 2017	Time Period Years 20	Net Benefit (Present Value (PV)) (£m)		
			Low: 209	**High:**	**Best Estimate:** 218

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low				
High			4	**51**
Best Estimate			3	**39**

Description and scale of key monetised costs by 'main affected groups'

In the central scenario, the AD electricity generation foregone is assumed to be replaced by natural gas, and the AD heat generation foregone, by heat from a mixture of gas, gas oil and biomass-fired boilers. The extra resource costs and carbon emissions associated with this alternative generation are the main monetised costs.

Other key non-monetised costs by 'main affected groups'

Administrative costs related to compliance with feedstock restrictions and sustainability criteria are likely to increase. Air quality is likely to deteriorate due to the increase in fossil fuel energy generation that replaces foregone AD generation. Impact on employment in the AD and mCHP industries is expected to be small, in line with the scale of the impact of the changes on deployment projections.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low				
High			17	**260**
Best Estimate			17	**257**

Description and scale of key monetised benefits by 'main affected groups'

New deployment of AD capacity decreases, resulting in a decrease in generation from AD. This leads to a monetised reduction in generation resource costs. The introduction of feedstock restrictions and sustainability criteria will lead to a monetised benefit through lower greenhouse gas emissions, even after netting off the estimated increase in greenhouse gas emissions due to lower deployment of AD.

Other key non-monetised benefits by 'main affected groups'

There are macroeconomic benefits related to lower electricity bills which are not monetised. There are also likely to be some wider system benefits, such as changes to transmission and distribution costs, which are not considered in the NPV. The impact of changes to mCHP policy is not monetised because robust evidence on this technology is not available as a result of historically low deployment levels.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

The analysis is based on an updated set of assumptions, some of which have a degree of uncertainty associated with them. Evidence on mCHP, in particular, is scarce.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	**Benefits:**	**Net:**	

Contents

1. Background

1.1. The Government Consultation conducted last year on a review of support under the Feed-in Tariffs (FITs) scheme for anaerobic digestion (AD) and micro combined heat and power (mCHP), to which this Government Response and Impact Assessment pertain, constituted the second phase of the comprehensive review of the FITs scheme that had been launched in 2015.

1.2. The Government Response[1] and Impact Assessment[2] published on 17 December 2015 covered the review of assumptions and tariffs for other technologies supported under FITs (i.e. solar PV, wind and hydro), as well as the introduction of quarterly deployment caps for all technologies, including AD, but not including mCHP. On publication, Government made clear its intention to address outstanding issues in a subsequent Consultation, which was launched in May 2016[3].

1.3. This Impact Assessment covers the review of assumptions and tariffs for AD and mCHP as well as the introduction of a deployment cap for the latter technology. For context, it should be read in conjunction with the Impact Assessment accompanying the Government Response and Impact Assessment published in December 2015.

2. Rationale for intervention

2.1. FITs is funded by electricity consumers through additions to their bills, along with other subsidies for low-carbon electricity generation: the Renewables Obligation (RO), Contracts for Difference (CfDs) and Final Investment Decision Enabling for Renewables (FIDeR). In order to limit the impact of these 'green levies' on consumer bills, Government decided to put in place the Levy Control Framework (LCF) in 2011.

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/487300/FITs_Review_Govt__response_Final.pdf

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486084/IA_-_FITs_consultation_response_with_Annexes_-_FINAL_SIGNED.pdf

[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/535842/FITs_ADmCHP_consultation_document_May_2016_1_-_14_July_deadline.pdf

Subsequent projections for spending under the LCF, however, substantially exceeded the original trajectory of reaching £7.6bn (in 2011/12 prices) by 2020/21[4].

2.2. The European Commission's State aid approval for FITs requires Government to review "the costs of technologies, electricity price forecasts and whether the target rate of return is still appropriate, and consider the revision of tariff levels and decrease rates accordingly" every three years. In compliance with this requirement, Government launched comprehensive reviews of the FITs scheme in 2012[5] and in 2015. These reviews involved updating the evidence base on each technology, and resulted in revisions to the scheme and reductions in tariffs.

2.3. The purpose of the policy changes discussed in this Impact Assessment is to ensure that:

- FITs policy for AD and mCHP is aligned with other technologies;
- deployment and spending under FITs remains controlled; and
- AD plants operate in a sustainable way, including the use of sustainable feedstock.

3. Supporting evidence

Anaerobic digestion

3.1. The setting of FITs and the production of deployment projections are based on a number of assumptions made about the economic and technical parameters of individual installations. These include, among others:

- costs, e.g. capital expenditure, operating expenditure, feedstock costs;
- revenues, e.g. electricity and heat bill savings, payments from the Renewable Heat Incentive (RHI) scheme, gate fees;
- investor characteristics, e.g. hurdle rates;
- technical characteristics, e.g. installation size, load factor, export fraction, operating life, feedstock mix.

3.2. For the 2015 Review, Government had appointed WSP Parsons Brinckerhoff, an engineering consultancy, to produce a report on small-scale renewable generation technologies. The resulting Small-Scale Generation Cost Update was published in August 2015[6]. Evidence from the 2014 Biomethane Review[7] was used to supplement this report with data specific to combined heat and power (CHP) AD plants.

3.3. Responses to the Consultation that supplied usable and evidenced data points were added to the Parsons Brinckerhoff data set, using the same methodology as outlined in the Impact Assessment to the 2015 Government Response. Additional evidence from Waste and Resources Action Programme (WRAP), a charity, and the National Non-Food Crops Centre (NNFCC), a bioenergy consultancy, was also incorporated into the evidence base.

3.4. Some of the assumptions used for the Consultation have been revised in the light of new evidence. These are discussed in more detail below. Table 1 summarises the main AD assumptions that have not been changed from the Consultation.

[4] The latest LCF spend projections published by the Office for Budgetary Responsibility are accessible at http://budgetresponsibility.org.uk/download/economic-and-fiscal-outlook-supplementary-fiscal-tables-receipts-and-other-november-2016/

[5] Phase 2A: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/43085/5386-government-response-to-consultation-on-comprehensi.pdf and Phase 2B: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42909/5901-fits--government-response-to-consultation-on-comp.pdf

[6] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/456187/DECC_Small-Scale_Generation_Costs_Update_FINAL.PDF

[7] https://www.gov.uk/government/consultations/rhi-biomethane-injection-to-grid-tariff-review

Table 1. Unchanged assumptions for AD

Assumption	Tariff band	Value
Capex	500-5,000 kW	£4,628/kW
Counterfactual heat fuel	all tariff bands	natural gas, gas oil, wood
Electricity uses	all tariff bands	on-site use, export, parasitic load
Export value	all tariff bands	current export tariff
Feedstock costs/revenues	0-250 kW and 250-500 kW	zero for manure/slurry and digestate
Heat-to-power ratio	all tariff bands	1.1:1
Target rate of return	all tariff bands	9.1%
Load factor	all tariff bands	91%
Reference size	0-250 kW	125 kW
	250-500 kW	375 kW
	500-5,000 kW	2,000 kW
Type of installation	0-250 kW	farm-based CHP
	250-500 kW	farm-based CHP
	500-5,000 kW	waste-fed CHP

Capex (0-250 kW and 250-500 kW tariff bands only)

3.5. Eleven new data points were received during the Consultation, which were incorporated into the data set. Respondents also commented that the capex figures derived from the Parsons Brinckerhoff report were too high in the 0-250 kW and 250-500 kW tariff bands. This is because an uplift had been applied to the original figures supplied by Parsons Brinckerhoff to account for the extra cost associated with CHP plants. Discussions with stakeholders revealed that the original costs already referred to CHP plants, therefore the uplift was removed. As a result of these changes, capex figures were revised downwards as shown in Table 2.

Table 2. Updated capex assumptions

Assumption	Tariff band	Consultation value	Government Response value
Capex (£/kW)	0-250 kW	£6,843	£6,055
	250-500 kW	£6,843	£5,340

Opex

3.6. The quality of evidence on opex was not sufficiently robust, therefore it was calculated as a fixed percentage (around 8%) of capex, a method commonly used by developers. This figure represents the typical value (median) of the data points supplied by Parsons Brinckerhoff and the seven responses submitted in the Consultation. The opex figure is assumed to capture the lifecycle cost of replacing AD components.

Table 3. Updated opex assumptions

Assumption	Tariff band	Consultation value	Government Response value
Opex (£/kW)	0-250 kW	£820	£509
	250-500 kW	£644	£449
	500-5,000 kW	£447	£389

Feedstock and gate fees (500-5,000 kW tariff band only)

3.7. Respondents commented that the assumption of 100% food waste feedstock in the 500-5,000 kW tariff band was implausible, and that a composition of 80% food waste and 20% other wastes and residues (such as dairy and abattoir wastes) was more realistic.

3.8. The gate fee assumptions used in the Consultation were based on the Biomethane Review and a report the generation costs and technical parameters of renewable technologies produced by Arup, an engineering consultancy[8]. These assumptions have been updated using the latest survey evidence available from WRAP and the relevant evidence provided by an AD plant and related invoices submitted in the Consultation. Respondents claimed that increased demand for feedstocks could reduce gate fees. Several respondents suggested that Government needs to do more to improve waste feedstock availability, such as banning biodegradable waste from landfill and supporting separation of food waste collections.

3.9. These points are reflected in the change of assumptions. The gate fee for food waste, which accounts for 80% of the total feedstock tonnage, has been revised from £20 to £15 per tonne. For the remaining 20% of feedstock, which is made up by other wastes and residues, the gate fee assumption is £3 per tonne. The weighted average of these two figures gives the new gate fee assumption of £12.60 per tonne of feedstock.

Table 4. Updated feedstock and gate fee assumptions

Assumption	Tariff band	Consultation value	Government Response value
Feedstock	500-5,000 kW	100% food waste	80% food waste; 20% other waste
Gate fee (£/tonne)	500-5,000 kW	£20	£12.60

Electrical efficiency

3.10. The electrical efficiency assumption has been revised downwards in all three tariff bands because the evidence provided in the Consultation showed that the proposed values were at the top end of the credible range when using natural gas, and did not take into account the potential efficiency penalty associated with using biogas.

Table 5. Updated electrical efficiency assumptions

Assumption	Tariff band	Consultation value	Government Response value
Electrical efficiency (kWh e/kWh th)	0-250 kW	38%	34%
	250-500 kW	40%	36%
	500-5,000 kW	42%	38%

Digestate disposal cost (500-5,000 kW tariff band only)

3.11. The digestate disposal cost assumption has been revised downwards, as a result of an update of the evidence base, which led to a decrease in the assumed cost of disposal (from £10 to £5 per tonne). In the analysis, it was assumed that digestate tonnage is 81.4% of the feedstock input.

Table 6. Updated digestate disposal cost assumption

Assumption	Tariff band	Consultation value	Government Response value
Digestate disposal (£/kW)	500-5,000 kW	£289	£94

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566718/Arup_Renewable_Generation_Cost_Report.pdf

Heat use

3.12. The evidence on useful heat and heat loss was updated with data on example projects provided in the Consultation and from self-reports on heat use submitted under the RHI scheme. This led to a substantial decrease in the assumption on useful heat, and a corresponding increase in the assumed heat loss.

3.13. Useful heat now takes into account parasitic heat use, and focuses only on heat uses in the vicinity of the AD plant, either on-site or on-farm. Examples of such heat use include space heating, pasteurisation and drying of woodchips. Digestate drying, however, is excluded, as this will no longer be eligible for RHI payments.

Table 7. Updated heat use assumptions

Assumption	Tariff band	Consultation value	Government Response value
Heat use	all tariff bands	80% useful heat 20% heat loss	58% useful heat 42% heat loss

RHI tariff

3.14. As stated in the Consultation, Government wishes to incentivise CHP over power-only installations through the feed-in tariffs scheme. Therefore, for the purposes of the tariff calculation, the reference plant in each tariff band is assumed to be eligible for the RHI.

3.15. All plants in the 0-250 kW tariff band, for example, are assumed to be in receipt of the RHI Medium Biogas tariff. But, because the tariff bands of the two schemes do not align perfectly, plants below 80 kW may be receiving the RHI Small Biogas tariff instead. This could result in overcompensation for these plants, but this risk is offset by the fact that such small installations tend to have higher costs than the figures used in the tariff setting.

3.16. The Government Response to the RHI Consultation of 2016 was published in December 2016[9]. This contained an updated set of RHI tariffs, which will be in effect in April 2017. This new set of RHI tariffs was used in the updating of the FITs, as shown in Table 8.

Table 8. Updated RHI tariff assumptions

Assumption	Tariff band	Consultation value (2016 prices)	Government Response value (2017 prices)
RHI tariff (p/kWh th)	0-250 kW	4.63	3.47
	250-500 kW	1.73	1.30
	500-5,000 kW	1.73	1.30

Micro-CHP

3.17. Before the Consultation, Government had very little evidence on the technical parameters of mCHP because of historically low deployment figures. During the Consultation, some relevant evidence was received and incorporated into the updated assumptions that informed our analysis. As there are relatively few players on the market at the moment, and individual mCHP units have distinct operating parameters, a detailed discussion of these assumptions would risk the disclosure of commercially sensitive information, and is therefore not appropriate here.

3.18. There is a similar lack of robust evidence on the economic characteristics of installing and operating mCHP. The figures submitted by respondents to the Consultation were typically based on business plans and internally produced estimates. Where no verifiable or documented source was given, these data points were considered but could not form

[9] https://www.gov.uk/government/consultations/the-renewable-heat-incentive-a-reformed-and-refocused-scheme

the basis of robust analysis. Crucially, no documented information was provided on hurdle rates. As a result, the standard tariff-setting procedure could not be applied, and mCHP tariffs could not be updated.

3.19. Before the Consultation, Government based its deployment forecasts for mCHP on historical trends, which showed very little uptake in the past and no increase in the rate of installation. Those respondents to the Consultation who operate in the mCHP business claimed that dramatic growth in the number of mCHP units accredited on FITs was possible in the near future, and they submitted deployment projections totalling around 20 MW of installed capacity by the end of 2018/19. In order not to stifle the growth of this industry, Government chose to accept this figure as its updated deployment forecast. Although the respondents' deployment projections can be assumed to include a degree of optimism bias, Government decided not to apply any discount factors to them in order to accommodate potential future players in the mCHP market.

3.20. At the time of the Consultation, the latest available evidence on mCHP load factors was the figure published in the annual report produced by the Department for Energy and Climate Change[10]. This analysis is based on a sample of installations accredited on the FITs scheme. As this data set is relatively small (just 13% of the total), and mCHP units installed in the future are expected to have different operating parameters from existing ones, Government decided to update its load factor assumption to equal the average of load factor values submitted in the Consultation, weighted by the respondents' projections of total capacity installed for each type of unit. This means, in effect, that the new load factor assumption corresponds to the hypothetical average installation that will be deployed between April 2017 and April 2019.

Table 9. Updated mCHP load factor assumption

Assumption	Consultation value	Government Response value
Load factor (%)	23%	46%

Modelling method

3.21. Deployment projections, which underlie estimates of future generation and spending under the FITs scheme, are produced using BEIS's FITs Deployment Model, which forecasts deployment each month by performing the following steps:

(i) Calculate the distribution of levelised costs for each technology and tariff band for installations deployed that month. The model assumes that levelised costs follow a normal distribution, and depend on capex, opex and investor hurdle rates.

(ii) Calculate the levelised revenue for each technology and tariff band for installations deployed that month. The levelised revenue consists of generation tariffs, export tariffs and bill savings for electricity and heat (where applicable).

(iii) Calculate the percentage of the levelised cost distribution that is lower than or equal to the levelised revenue. This represents the total demand that is willing to install that month, i.e. projects for which levelised costs are no higher than levelised revenues, taking their hurdle rate into account.

(iv) Apply this percentage to the maximum possible deployment that month, which is calculated as the available technical potential, constrained by the lower of the social barrier (which represents people's willingness to invest in renewable technologies) and the market barrier (which represents awareness of and availability of supply chains for a technology). These barriers are set by calibrating the model through comparing previous forecasts to actual deployment figures.

[10] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/487858/Feed-in_Tariff_load_factor_analysis.pdf

(v) Finally, monthly demand for deployment is aggregated to quarters. The capping and degression mechanisms are applied as needed, and the process is repeated for the next quarter, with reference to the new generation tariffs.

3.22. More detail on the modelling is available in Annex D of the Impact Assessment published with the Government Response to the 2015 Review.

4. Options considered

Anaerobic digestion

4.1. The Consultation presented the following options:

(i) to do nothing;
(ii) to update generation tariffs on the basis of new evidence for all tariff bands, and introduce default degression;
(iii) to update generation tariffs on the basis of new evidence for the 500-5,000 kW band and on the basis of the queue of applications for the 0-250 kW and 250-500 kW tariff bands, and introduce default degression.

4.2. In the Consultation, many respondents felt that the assumption in option (iii) above that the length of the AD application queue is a reliable indicator of market appetite for current tariffs, was unjustified. Stakeholder discussions revealed that once submitted, installers have no incentive to withdraw applications from the queue even if they later decide not to pursue accreditation. Information on attrition rates (i.e. the proportion of installers that apply for and receive pre-accreditation but do not subsequently apply for full accreditation) is not yet available, therefore Government decided not to consider the length of the AD application queue when setting generation tariffs, but rather to base them solely on the latest available cost evidence as detailed in Section 3 above.

4.3. The options discussed in this IA are as follows:

(i) Option 1: Do nothing;
(ii) Option 2: Implement the changes set out in the Government Response, i.e. revise generation tariffs on the basis of the latest available cost evidence and introduce default degression, sustainability criteria and feedstock restrictions.

Option 1: Do nothing

4.4. Under this option, no changes would be implemented to FITs policy as it applies to AD. This would be contrary to Government's declared intention to treat all technologies supported under the scheme equally, as established technologies. Current AD tariffs do not reflect the latest available evidence, and failing to review them would constitute a breach of the State aid approval of the FITs scheme, which requires Government to ensure the tariffs provide a fair rate of return to investors. In addition, AD is currently the only major technology supported under FITs whose tariffs are not subject to default degression, which is contrary to Government's aim to incentivise innovation and a continuous reduction in technology costs.

Option 2: Implement the changes set out in the Government Response

4.5. This option involves a revision of generation tariffs, implementing quarterly default degression, and the introduction of feedstock sustainability criteria as detailed in the Government Response.

4.6. Generation tariffs were reviewed in the light of new evidence on the technical and economic parameters of AD installations submitted by respondents and otherwise obtained by Government during the Consultation, as detailed in Section 3 above. The tariff-setting followed the same procedure as for other technologies covered in the Core Review of the FITs scheme conducted in 2015. In particular, tariffs were set so as to

incentivise well-sited CHP installations. The resulting tariffs, including the impact of default degression but not including any contingent degression, are set out in Table 10. These tariffs are higher, in every tariff band, than those consulted on. The largest difference is in the 500-5,000 kW tariff band, where the preferred consultation proposal was a zero generation tariff.

Table 10. AD generation tariffs as of 1 April 2017 (p/kWh, 2017 prices)

	2017			2018				2019
Tariff band	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**
0-250 kW	6.93	6.88	6.83	6.78	6.73	6.68	6.63	6.58
250-500 kW	6.56	6.51	6.47	6.43	6.38	6.34	6.30	6.25
500-5,000 kW	2.49	2.45	2.42	2.38	2.35	2.31	2.27	2.24

4.7. Government decided to align FITs policy for AD with other supported technologies and introduce quarterly default degression for two reasons. Firstly, to incentivise innovation, and secondly, to ensure that investors who join the scheme early and drive subsequent technology cost reductions receive the same rate of return as those who join later. Projected changes to bill savings and to the cost of installations are taken into account when calculating the generation tariff required to achieve the target rate of return over time. Future bill savings are estimated with reference to electricity and fossil fuel price projections; future trends in costs are based on the Parsons Brinckerhoff report and responses to the Consultation. For the purpose of calculating default degression, tariff reductions are smoothed over time and averaged equally across each quarter from April 2017 to March 2019, as set out in Table 11.

Table 11. AD tariff default degression

	2017			2018				2019
Tariff band	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**
0-250 kW	n/a	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
250-500 kW	n/a	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
500-5,000 kW	n/a	-1.4%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.6%

4.8. The impact of the sustainability criteria and feedstock restrictions that will be introduced for AD on 29 April 2017 was considered in detail when estimating the monetised and non-monetised costs and benefits of implementing the policy changes set out in the Government Response. These are discussed in Section 5 below.

Micro-CHP

4.9. The Consultation presented the following options:

(i) to do nothing;
(ii) to introduce annual deployment caps and contingent degression for mCHP so as to limit annual spending (in LCF terms) on this technology to £1m.

4.10. In the Consultation, Government proposed to limit spending on mCHP to £1m because historical deployment of this technology had been very low. Using the latest available evidence, Government estimated that £1m would be sufficient to bring forward 3.6 MW of mCHP, over five times more than what had deployed so far. Thus, the need to limit the risk of breaching the £100m spending cap agreed with HM Treasury could be reconciled with setting the cap at a level that would not stifle the industry.

4.11. Respondents to the Consultation, while acknowledging that deployment had been slower than anticipated at the launch of the FITs scheme, claimed that recent technological

developments would allow the industry to start deploying mCHP at scale, but that this was only possible in an atmosphere of investor confidence, which presupposed a deployment cap far higher than the originally proposed 3.6 MW.

4.12. In order to allow deployment of this technology at scale, and in the light of updated evidence on the level of underspend in the FITs scheme, Government decided to review the proposed deployment cap for new installations and set it at 20 MW, which corresponds to the total of deployment projections submitted in the Consultation, as detailed in Section 3 above.

4.13. Therefore the options discussed in this IA are as follows:

(i) Option 1: Do nothing;
(ii) Option 2: Introduce six-monthly deployment caps of 5 MW each, and contingent degression for mCHP.

Option 1: Do nothing

4.14. Under this option, no changes would be implemented to FITs policy as it applies to mCHP. In an extreme case, if the current eligibility limit of 30,000 units were reached, additional spend on the technology could reach up to £42.9m (in 2011/12 prices). This would pose a significant risk of breaching the £100m spending cap agreed with HMT, and would necessitate disproportionate alterations to FITs rates and/or deployment caps across all technologies.

Option 2: Introduce six-monthly deployment caps and contingent degression

4.15. This option represents aligning mCHP policy with how other technologies are treated under FITs although, to account for the fact that mCHP is a less mature technology, deployment caps are extended from quarterly to six-monthly periods, and default degression will not be introduced. Deployment caps will operate in the same way as for other technologies, i.e. unused capacity will be rolled forward to the next period, and each time the cap is filled, future tariffs will be subject to a 10% contingent degression. The number of units supported corresponding to each six-monthly period in Table 12 were calculated using the average of unit capacity values submitted in the Consultation, weighted by the respondents' projections of total capacity installed for each type of unit. As a result, the numbers refer to the hypothetical average installation that will be deployed between April 2017 and April 2019, and are given below only as an indication.

Table 12. Six-monthly deployment caps for micro-CHP

Period	Deployment cap (MW)	Equivalent number of units (approximately)
1 April to 30 September 2017	5	3,840
1 October to 31 March 2018	5	3,840
1 April to 30 September 2018	5	3,840
1 October to 31 March 2019	5	3,840
Total over period	20	15,360

4.16. Government did not propose to review the mCHP generation tariff, and the evidence submitted in the Consultation was not sufficient to calculate a new tariff using the standard methodology. Consequently, Government has maintained the current level of the mCHP generation tariff.

Table 13. Micro-CHP generation tariff as of 1 April 2017 (p/kWh)

Tariff band	Consultation value (2016 price base)	Government Response value (2017 price base)
Micro-CHP	13.61	13.95

4.17. The 13.61 p/kWh generation tariff proposed in the Consultation was given in a 2016 price base whereas the 13.95 p/kWh generation tariff in this IA is in 2017 prices. This means that it has been adjusted by 2.5%[11] as per the normal indexation procedure[12]. The two figures are equal in real terms.

5. Costs and benefits of each option

5.1. This section assesses the likely impact of each option for changes to AD policy discussed in Section 4, based on the assumptions set out in Section 3.

Option 1: Do nothing

5.2. The costs and benefits of this option are, by definition, zero. This option is used as the baseline to assess the other option.

Option 2: Implement the changes set out in the Government Response

Deployment and generation

5.3. The overall impact of this option is a slight reduction in AD deployment, the number of installations and the amount of electricity generated, as set out in Table 14 to Table 16 below. The number of installations is calculated by dividing total capacity deployed in each tariff band by the appropriate reference installation size. As such, it is only an approximation and is provided below for information.

5.4. In each of these tables, three scenarios are presented, reflecting the uncertainty in deployment projections. The low, central and high deployment scenarios are calculated by using high, medium and low hurdle rates in the FITs Deployment Model, respectively.

5.5. As generation tariffs will not be available for new installations after March 2019, total installed capacity and the number of installations do not increase after this date. Annual generation, however, will increase for one more year as installations deployed throughout 2018/19 will not have generated for the entirety of that year, but will have in 2019/20. From 2020/21 onwards, capacity and generation under the FITs scheme will remain steady until the earliest installations start reaching the end of their technological lifetime in 2030/31.

[11] https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/chaw/mm23

[12] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/175368/FITs_Factsheet--RPI_link-Export_Tariffs-2_Month_Degression.pdf

Table 14. Installed AD capacity at the end of each FITs year (MW)

Deployment scenario	Option	2017/18	2018/19	2019/20	2020/21
Low	Option 1: Do nothing	295	305	305	305
	Option 2: Implement changes	292	301	301	301
	Difference from baseline	-3	-3	-3	-3
Central	Option 1: Do nothing	296	309	309	309
	Option 2: Implement changes	295	305	305	305
	Difference from baseline	-1	-4	-4	-4
High	Option 1: Do nothing	296	313	313	313
	Option 2: Implement changes	296	310	310	310
	Difference from baseline	0	-3	-3	-3

Table 15. Number of AD installations at the end of each FITs year

Deployment scenario	Option	2017/18	2018/19	2019/20	2020/21
Low	Option 1: Do nothing	505	533	533	533
	Option 2: Implement changes	503	530	530	530
	Difference from baseline	-2	-3	-3	-3
Central	Option 1: Do nothing	525	564	564	564
	Option 2: Implement changes	516	543	543	543
	Difference from baseline	-9	-21	-21	-21
High	Option 1: Do nothing	546	597	597	597
	Option 2: Implement changes	534	573	573	573
	Difference from baseline	-12	-24	-24	-24

Table 16. Annual generation from AD in each FITs year (GWh)

Deployment scenario	Option	2017/18	2018/19	2019/20	2020/21
Low	Option 1: Do nothing	2,278	2,394	2,428	2,428
	Option 2: Implement changes	2,266	2,365	2,401	2,401
	Difference from baseline	-12	-29	-27	-27
Central	Option 1: Do nothing	2,281	2,414	2,461	2,461
	Option 2: Implement changes	2,277	2,394	2,431	2,431
	Difference from baseline	-3	-20	-30	-30
High	Option 1: Do nothing	2,283	2,428	2,492	2,492
	Option 2: Implement changes	2,281	2,419	2,470	2,470
	Difference from baseline	-2	-9	-22	-22

Resource costs

5.6. The net present value (NPV) of implementing the changes set out in the Government Response is calculated as the sum of the costs and benefits of the intervention, i.e. the change in resource costs and carbon emissions, relative to baseline (i.e. Option 1). Both costs and benefits are discounted at 3.5% as per the Green Book.[13]

5.7. Although based on the best available evidence available to Government, there is a substantial degree of uncertainty around these estimates, which should therefore be considered only as an indication of the most likely impact. One example of this

[13] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf

uncertainty is the range of deployment projections. As the cost-benefit analysis is based on the central deployment scenario, this source of variance is not reflected in the results.

5.8. Overall, the analysis shows that AD deployment under FITs will be reduced as a result of the changes to the policy. This results in a decrease in the resource costs of generation from AD. The electricity and heat lost is assumed to be replaced by alternative sources. The change in electricity output was monetised using the short-range marginal cost (SRMC) of electricity generation, which represents a gas plant. This assumption is justified because the changes in electricity generation are relatively small.

5.9. The analysis also includes a monetisation of changes in AD output caused by the intervention in terms of the long-run variable cost (LRVC) of electricity instead, which represents the average, rather than the marginal, cost of electricity generation.

5.10. The heat generation from AD lost as a result of the intervention was assumed to be substituted for by other sources: natural gas for plants larger than 500 kWe and a mix of natural gas, gas oil and wood pellets for plants at or below 500 kWe.

5.11. Table 17 shows that overall, the policy changes detailed in the Government Response lead to a reduction in resource costs. This is primarily driven by the difference in the cost of generation from AD and from alternative source (grid average for LRVC and natural gas for SRMC).

Table 17. Resource costs of Option 2 (present value £m, 2017 prices)

Source of change	LRVC	SRMC
AD deployment	-44.9	-44.9
Electricity grid replacement	34.1	21.7
Alternative heat fuel	11.8	11.8
Transmission and distribution costs	-3.3	n/a
Total	**-2.3**	**-11.5**

Carbon emissions

5.12. The impact of introducing feedstock restrictions is also monetised. The level of emissions associated with different feedstock types are based on the net emissions published in the Government Response to the RHI Consultation of 2016. This takes into account direct emissions, methane leakage and saved upstream emissions for food waste, crops and manure/slurry. The emissions levels are valued at the non-traded carbon price, set out in the Green Book supplementary guidance on the valuation of energy use and greenhouse gas emissions.[14]

5.13. Overall, the introduction of feedstock restrictions has a positive impact on carbon emissions, as more methane is burnt that would otherwise have been released into the atmosphere as a result of waste decay. Unlike crops, food waste and agricultural waste (either manure or slurry) help in reducing emission levels from AD generation.

5.14. The AD generation lost under Option 2 is assumed to be replaced by electricity from the grid and a mix of alternative heat fuels. This increases emissions from heat generation as alternative fuels must be burnt to generate heat. The monetised impact of additional carbon emissions from electricity is already captured in the LRVC and SRMC used in the resource costs analysis above.

[14] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Table 18. Carbons savings under Option 2 (present value £m, 2017 prices)

Option	Source of carbon emissions savings	Monetised value
Option 1	AD deployment without feedstock restrictions	252.1
Option 2	AD deployment with feedstock restrictions	464.3
	Use of alternative heat fuel	-5.6
	Net carbon emissions savings (Option 2 total minus Option 1 total)	**206.6**

5.15. The NPV of implementing the changes set out in the Government Response is calculated by combining the change in resource costs and net carbon emission savings relative to no intervention. Table 19 shows that the benefits of Option 2 are twofold. On the one hand, there is a small reduction in resource costs because some AD generation is lost and replaced by cheaper alternatives. The main benefit of Option 2, however, is the increased carbon emission savings resulting from the introduction of feedstock restrictions.

Table 19. Net present value of Option 2 (£m, 2017 prices)

	Source	LRVC	SRMC
(-)	Resource cost change	-2	-11
(+)	Net carbon emission savings	207	207
	Total	**209**	**218**

Cost to consumers

5.16. Generation tariff and deemed export payments made by FITs licensees are passed on to consumers through their electricity bills. These costs are included in the LCF, and are accounted for in 2011/12 prices. Table 20 shows the impact of each option on LCF spending. For the purposes of this table, it is assumed that all AD installations have power purchase agreements in place, and receive no deemed export payments.

Table 20. Annual LCF spend from deployment at the end of each FITs year (£m, 2011/12 prices)

Option	Deployment scenario	2017/18	2018/19	2019/20	2020/21	Relative to Option 1 in 2020/21
Option 1: Do nothing	Low	210	214	215	215	
	Central	210	214	216	216	
	High	210	215	216	216	
Option 2: Implement changes	Low	207	209	210	210	-5
	Central	208	209	210	210	-6
	High	208	209	210	210	-6

5.17. The direct impact of the LCF spending shown in Table 20 above is illustrated in Table 21, for a typical households and illustrative business user categories, relative to the same scenario under the do nothing option. For domestic users and small businesses, the impact of the changes is effectively zero, because of the small difference in generation estimates under the two options. These figures are exclusive of merit-order effects, i.e. the indirect impact of FITs deployment on the wholesale market, which also have an effect on consumer bills.

Table 21. Direct impact of changes on consumer bills (in 2020/21, in 2017 prices)

Option	Deployment scenario	Domestic	Small businesses	Medium businesses	Energy-intensive industries (non-exempt)
Option 1: Do nothing	Low	3	200	8,300	78,000
	Central	3	200	8,300	78,000
	High	3	200	8,300	78,000
Option 2: Implement changes	Low	3	200	8,100	76,000
	Central	3	200	8,100	76,000
	High	3	200	8,100	76,000

6. Non-monetised costs and benefits

6.1. The impact of changes to mCHP policy is not monetised because the evidence on this technology available to Government is not sufficiently robust to conduct a costs and benefits analysis. Considering the relatively little installed capacity of this technology, however, it is expected that the monetised impact of the proposed changes would be small.

6.2. Implementing the changes set out in the Government Response is expected to result in a reduction in generation from AD. The foregone generation is assumed to be replaced by alternative fuels, which may increase greenhouse gas emissions. As the reduction in generation is relatively small, the negative impact is expected to be marginal.

6.3. The change in generation under FITs may also entail wider system impacts (both positive and negative) that are not quantified in the analysis presented above.

6.4. Option 2 is expected to lead to lower electricity bills, which will have positive macroeconomic impacts, such as lower business costs, increased competitiveness for UK businesses, and increasing consumers' disposable income.

6.5. There may also be an impact on supply chains for both AD and alternative generation sources. The net impact of these is unclear and expected to be negligible.

6.6. Although FITs deployment is expected to decrease as a result of the changes (see Table 14), which may have an impact on the number of jobs supported by the scheme, the decrease in capacity is relatively small and therefore the impact on employment is expected to be negligible. An increasing number of the 3,000-4,000 jobs in the AD sector are in the operation and maintenance of plants[15], which are less affected by deployment levels. Also, the impact of the changes is limited to the period up to April 2019, when the FITs will be closed to new installations, as no decisions have yet been taken about the future of the scheme beyond that point.

[15] http://adbioresources.org/adba-market-policy-reports/adba-market-report