UPDATES TO THE FEED-IN TARIFFS MODEL
DOCUMENTATION OF CHANGES MADE FOR NON-PV TECHNOLOGIES

7 February 2012

FINAL

Submitted by:

Cambridge Economic Policy Associates Ltd
and Parsons Brinckerhoff

CONTENTS

1. SCOPE OF WORK, AND SUMMARY OF CHANGES

This report documents the changes that PB and CEPA made to DECC's model for Feed-in Tariffs (FITs) during July and August 2011 for non-PV technologies supported under the FITs scheme. The report is a specially amended version that focuses on the changes made to technology cost and performance assumptions and the evidence base underpinning these changes.

1.1. Structure of document

We start by discussing how we have updated the model's input assumptions. Section 2 documents the updates we have made to the technology input assumptions. This includes updates to the technology costs and the potential for technology deployment. Updates to assumptions on Solar PV were documented in our previous report[1] which was published as part of Phase 1 of the Comprehensive Review of FITs. That report also included a section on how we arrived at revised hurdle rates for investors.

Section 3 discusses a number of issues we have identified with the model. While a review or audit of the model was not within our terms of reference, in doing our work we came across aspects of the model that we considered it was appropriate to highlight.

Data sources are provided at Annex A and data tables showing all the updated inputs are included in Annex B.

[1] http://www.decc.gov.uk/assets/decc/11/consultation/fits-comp-review-p1/3365-updates-to-fits-model-doc.pdf

2. TECHNOLOGY INPUTS

This section describes the revisions we have made to the input cost and technology data used in the FITs model. Following discussion with DECC, we reviewed data for those technologies that are currently eligible for FITs. For those technologies, we have revisited the range of assumptions, including:

- The technology banding, including the size of each band and the number of bands, and what a typical installation within each band might be.
- The export fraction – that is, the percentage of the output of a typical installation that would be sold back to the national electricity grid, rather than being used onsite.
- Capital costs, both current and projected.
- Operating costs, again both current and expected.
- Load factors.
- The technical potential of the technology. This is a theoretical maximum, and is very unlikely to be approached or achieved in practice. It is however used within the model as a key input for uptake and supply chain development.
- The expected lifetime of the technology.
- Uptake to end March 2011.

A range of different sources have been used to develop the revised input data. These sources are listed in Annex A. In general, our approach has been to combine data from industry discussions with recent independent reports and our own project experience to derive updated values. The majority of the data used was collected during July 2011.

As noted above, part of the scope of our work has been to provide future cost projections to 2030. While we have sought to provide reasonable estimates based on possible future technology and market developments, such estimates are by nature uncertain, particularly over the 20 year time-span to 2030.

Capital and operating costs have been derived with Low, Medium and High cases. The Low and High cases are based on the range of data received, plus our own experience and judgement as to what values would be reasonable. The Medium case values are based on where the data "clusters", i.e. where the majority of the data points lie. The Medium case value is not the mean of the Low and High case values, although in some cases it may result in a value close to the mean.

We now turn to a detailed description of the updates we have made, by technology and by assumption type. Each sub-section below briefly summarises the key updates we have made, for each individual technology, before providing a breakdown by type of input.

2.1. Wind

For wind installations registered under the FITs scheme, information on the capital costs has been updated to reflect recent price data. Other adjustments have been made including changes to load factors and export fractions compared to the previous model. Aggregator bands have also been introduced; these changes are in response to market developments since the FITs scheme was introduced.

Details of how inputs to the model have been derived are provided below.

2.1.1. Bands

We have added aggregator bands in response to market information that this is being considered for the larger wind bands (100-500kW and 500-1500kW).

We have also included mast-mounted micro wind into either the <1.5kW band or the 1.5-15kW band.

2.1.2. Technology size

The size of a typical installation within each band has been based on the average size of installations registered for FITs to date. For larger bands where there have been few installations to date we have based the typical size on values towards the higher end of the range for 100-500 and 500-1,500kW, particularly for the latter band where 1,300kW turbines are widely available. This is on the basis that projects will seek to be on the larger side within each band to benefit from economies of scale.

2.1.3. Export fraction

We have applied export fractions that are generally lower than the values in the previous model. For domestic turbines we consider that household demand will normally exceed the small output from a <1.5kW turbine, leading to very low export levels. For larger turbines up to 100kW we have assumed rising levels of exports as the level of generation begins to exceed on-site demand, particularly in rural areas where our judgement is that it is more likely that generation will exceed on-site demand (compared to urban areas where turbines are more likely to be associated with buildings with significant on-site use). The range applied between the low and high cases is relatively wide, however, based on the wide range of possible combinations of generation and demand profiles. Real data from operating installations would be helpful in clarifying these export fraction values. For turbines above 100kW we have assumed 90% exports to reflect most of these sites being designed for export only, while allowing for a small number of installations on large industrial sites with significant on-site demand.

2.1.4. Capex

The capital cost for <1.5kW wind turbines has been reduced compared to the previous version of the model, based on the range of actual market prices for turbines of this type and size[2]. Costs for larger installations are somewhat higher than the previous model, particularly for mid-sized projects, again reflecting actual market prices.

Capex is expected to decline in future, though not as fast as in the previous model. In the medium case, costs remain flat until 2015 before declining gradually thereafter. This is based on

[2] Costs for turbines of 1 – 1.5kW capacity can range from £1,500 to £5,000 or more.

industry expectations and the significant portion of the cost determined by raw material costs which are not expected to fall significantly. The possibility of higher material prices pushing capex up over the next few years is taken into account in our high end capex estimate.

Capital costs for aggregators are assumed to be slightly lower than for individual installations, based on achieving economies of scale in purchasing and other project costs.

2.1.5. Opex

Operating costs for the <1.5kW and 1.5-15kW bands are lower than the previous model on the basis that servicing may be less frequent and more likely to be based on the need to repair faults rather than a regular annual service.

Opex for larger installations is in line with the previous model.

Operating costs for wind aggregators are assumed to be slightly lower than for individual installations, based on achieving some economies of scale from operating a fleet of similar installations.

Future operating costs are expected to be lower than today, but not to fall as fast as in the previous model. This is based on the expectation of only incremental improvements in reliability and spares costs.

2.1.6. Load factors

Load factors are generally somewhat higher than those in the previous model, based on modelling representative turbine power curves for the different wind speed bands, and on the view that projects will tend towards better sites with higher wind speeds.

Note that the load factors were calculated assuming the nominal wind speed bands in the model (5.5m/s, 6m/s etc.) to be the wind speed at 45 mAGL (metres above ground level). A standard hub height for each size band was then assumed and the 45 mAGL wind speed was extrapolated to the hub height. Therefore the actual wind speeds used to calculate the load factors were different to the nominal bands in the model (i.e. lower for smaller turbines with hub height <45mAGL, higher for larger turbines with hub height > 45mAGL). This provides a more accurate representation of the actual load factors that can be expected for different turbine sizes

2.1.7. Technical potential

We have maintained the same overall technical potential for wind as the previous report, with 10% of potential from the appropriate bands allocated to aggregators.

It is not clear from the data available on the previous model which designated area constraints were taken into account or what methodology was used to define potential turbine densities. As a sense-check, we estimated the number of turbines implied by the previous model's technical potential data and concluded that these provided reasonable order of magnitude values.

2.1.8. Lifetime

Installation lifetimes are in line with the previous model, with medium case estimates of 15 years for turbines <1.5kW and 20 years for turbines >1.5kW.

2.1.9. Uptake

Uptake values use data from Ofgem for installations up to the end of March 2011.

2.2. Hydro

The technical potential for hydro installations has been increased following work conducted by the Environment Agency and others on hydro potential in the UK. Minor adjustments have been made to other areas including load factors, lifetime of hydro systems and operating costs. Capital and operating costs have been adjusted upwards slightly compared to the values in the previous model.

Details of how inputs to the model have been derived are provided below.

2.2.1. Technology size

We have used slightly smaller typical installation sizes for the smaller size bands than the previous model, based on actual installations registered for FITs to date.

2.2.2. Export fraction

Export fractions for hydro installations are slightly lower (95-99%[3]) than the 100% assumed in the previous model. This is to allow for a small number of sites with some associated on-site load.

2.2.3. Capex

Hydro capital costs are slightly higher than those in the previous model, to reflect industry reports of increases in raw material and project costs. Note the wide range covered by the low, medium and high estimates. This reflects the fact that costs for the same installation capacity can vary significantly depending on site specific factors.

In line with the previous model, capital costs are expected to remain stable in future and this is reflected in the flat costs in our medium case.

2.2.4. Opex

Operating costs have also been adjusted upwards slightly compared to those in the previous model, again based on evidence of upward pressure on costs for recent projects. We have reallocated costs for some bands from marginal (£/kW) to fixed (£) to reflect the nature of how maintenance is carried out in practice.

2.2.5. Load factors

Load factors are slightly higher than those in the previous model to reflect typical values for UK hydro sites, on the assumption that projects will tend to favour sites with reasonable load factors.

---

[3] Except for hydro <15kW, where the export fraction is 75%.

2.2.6. Technical potential

Technical potential for hydro is higher than the previous model, based on recent data from the Environment Agency and others on UK potential and constraints.

2.2.7. Lifetime

The lifetime for hydro projects has been set at 25 years (compared to 20 in the previous model). This is intended to reflect the design lifetime of the turbine and other mechanical and electrical components, which represent a significant proportion of the overall capex. The civil engineering structures would be expected to have a considerably longer life. From a tariff-setting point of view we consider that the lifetime should be based on the project life on which initial investment is based and that the mechanical/electrical design life best reflects this.

2.2.8. Uptake

Uptake values use data from Ofgem for installations up to the end of March 2011.

2.3. Micro-CHP

Information on the development of fuel cell CHP prototypes has allowed slight adjustments to capital and operating cost information. As well as this more scenarios have been developed to allow for the different types of building which will be served by microCHP systems.

Details of how inputs to the model have been derived are provided below.

2.3.1. Technology size

Technology sizes are the same as those used in the previous model and are based on the 1kW capacity of all installations registered for FITs to date.

2.3.2. Export fraction

Export fractions for domestic CHP at 50% are the same as in the previous model, based on data from the Carbon Trust microCHP Accelerator field trials.

2.3.3. Capex

Capital costs compared to the previous model are the same for Stirling engine installations but higher for fuel cell installations. This is based on quotes obtained from existing suppliers for each type of unit. It should be noted that fuel cell CHP in particular is a new technology and costs are therefore subject to significant uncertainty.

Future capital costs are expected to decline. Stirling engine costs fall more slowly than in the previous model, based on industry expectations of future cost reduction trends. Fuel cell costs fall more quickly as early learning is applied, albeit from a higher initial starting point.

2.3.4. Opex

Operating costs for Stirling engine CHP are the same as the previous model based on an annual service. For fuel cell CHP, costs are slightly higher to reflect the more unusual and complex nature of the technology.

Future operating costs are expected to remain flat, as in the previous model.

2.3.5. Load factors

Compared to the previous model we have used different site types for microCHP to provide more clarity on the type of building being served. Load factors have then been based on our experience of heat and power demand profiles for each site type, on the assumption that the CHP units will be heat-led.

2.3.6. Technical potential

The technical potential for micro-CHP has been based on the report for the previous model, i.e. that there are in excess of 20 million properties that could ultimately convert from gas boilers to micro-CHP. These installations have been allocated between Stirling and fuel cell types, with the majority being Stirling engines based on this technology being more mature and lower cost and therefore more likely to be taken up. We have assumed that these installations will be shared between existing domestic and commercial buildings, as being the most suited to make use of the technology.

In practice, the number of installations that can be deployed each year will be limited by factors such as the capacity of the supply chain, at least in the short to medium term. We have provided supply chain capacity values for use in the model, based on informal discussions with industry as to current and likely future capability.

2.3.7. Lifetime

Based on discussions with suppliers, technology lifetimes compared to the previous model are slightly lower for Stirling engine CHP. Lifetimes are significantly lower for fuel cell CHP, based on actual supplier data and recent studies on the current capability of this relatively new technology.

2.3.8. Uptake

Uptake values use data from Ofgem for installations up to the end of March 2011.

2.3.9. Efficiency

Efficiencies for both Stirling engine and fuel cell systems have been updated to reflect data on current equipment capabilities.

2.4. Anaerobic digestion (AD)

The inclusion of AD in the Fast Track Review resulted in a different banding structure to encourage smaller systems, and this has been updated in the model. Actual operating data has been used to adjust previous model assumptions on load factors and export fraction.

Capital costs have been reduced slightly to reflect recent industry data. Operating costs for larger food waste AD facilities remain similar. Changes have been made to address the emergence of farm based AD systems which use mixtures of slurry and supplementary, higher energy content feedstocks such as maize. The previous model did not cover this type of operating cost at smaller scale.

Details of how inputs to the model have been derived are provided below.

2.4.1. Bands

Bands for AD have been updated to reflect the new size bands established following DECC's recent Fast Track Review for installations smaller than 500kW

2.4.2. Technology size

Typical technology sizes have been based on the average sizes of existing and proposed UK projects of which we are aware. This results in a slightly higher size for the >500kW band than in the previous model.

2.4.3. Export fraction

The export fractions for all the AD bands are slightly lower than the previous model (which assumed 100% export) to reflect some level of on-site use.

2.4.4. Capex

Capital costs are similar to the previous model for >500kW installations and slightly lower for <500kW installations, reflecting recent industry data.

Future capex is expected to decline slightly over time, compared to the stable cost profile in the previous model. This is based on the assumption that the AD industry in the UK will mature over time, allowing some reductions in cost through supply chain development, reduction in projects risks etc.

2.4.5. Opex

Operating costs for the >500kW systems are based on food waste AD to match the structure of the previous model. Total costs (excluding feedstock) for this size band are similar to the previous model. Gate fees received for waste have been updated to reflect recent industry data.

The previous model did not include costs for <500kW projects purchasing supplementary feedstocks. Recent data indicates that some farm slurry AD projects may do this, so we have provided two sets of operating cost data for the <500kW band, one with extra feedstock costs[4] and one without.

Future operating costs are assumed to be flat, as in the previous model.

2.4.6. Load factors

Load factors for AD up to 500kW are lower than in the previous model, based on recent industry data on actual load factors achieved in practice by UK installations.

The load factor is defined as the actual output over a year compared to the output from the installed capacity running continually throughout the year.[5]

2.4.7. Technical potential

Technical potential for AD is significantly lower than the previous model. Our value is based on recent data from DEFRA and others.

2.4.8. Lifetime

Installation lifetimes for AD are the same as used in the previous model.

2.4.9. Uptake

Uptake values use data from Ofgem for installations up to the end of March 2011.

---

[4] At a cost of £30/tonne and used as 25% w/w of the plant feed.

[5] i.e. load factor = (Output in kWh)/(installed capacity in kW x 8760 hours per year)

3. Some issues identified

In this section, we briefly discuss some of the issues we have found in updating the model.

We have not carried out a review of the model, since this was not in our terms of reference. However, in the course of our work we have discovered a number of issues with the way that the model works that we would like to bring to DECC's attention. For the avoidance of doubt, there is no guarantee that the model would be error-free even if all these issues were addressed, particularly given its size and the complexity of both its structure and formulae.

3.1. Investor myopia

The model assumes that all investors are myopic as far as the electricity price is concerned. When considering the future costs and benefits of installing renewables, investors make decisions on the basis that the electricity price in all future years will be the same as the current price.

This may be a reasonable assumption for households, but for commercial investors is unlikely to hold. In general, it will tend to make renewables investments look *less* attractive than they are in reality, and so will suppress uptake.

3.2. Wind generation

The model had been over-predicting the uptake of the smallest turbines (under 1.5kW). Given the capex, opex and load factor assumptions in the model, it is perfectly reasonable to predict high uptake in very windy sites (wind speed >8 metres per second). The question is why this is not happening in reality.

There are at least two possible explanations. The first is simply lack of awareness. The second is that the owners of these sites do not wish to install wind turbines because they see them as detracting from the landscape or the visual amenity of their homes. It is not clear which if either of these explanations is correct; this would require further analysis.

In the interim, we have used hurdle rates as a proxy for these other barriers. Adjusting the hurdle rates for sub-1.5kW wind turbines to 18% (close to the 16% figure used as the consumer discount rate in the Renewable Heat Incentive) brings the model's predicted installations in 2010 into line with actual installations.

3.3. Waste

Previous model versions grouped incineration and Advanced Thermal Treatment (ATT) technologies with large (over 500kW) anaerobic digestion, in the single "waste" category. The model has a single supply chain for waste, and so assumed that the historic development of incineration and ATT meant that capacity for installing any kind of waste technology had built up. AD is a very different technology to these two, so this is not a valid assumption.

We have therefore removed the ATT and incineration technologies, and uptake constraints have been changed to reflect that it is only one technology being considered.

ANNEX A: REFERENCES FOR COST AND POTENTIAL DATA UPDATES

In addition to PB's own recent project experience, the following external references have been used to help derive the updated cost and performance data.

General (used for more than one technology)

- "Design of Feed-in Tariffs for Sub-5MW Electricity in Great Britain - Quantitative analysis for DECC - Final Report", Element Energy/Pöyry for DECC, July 2009
- Input data used in previous version of model, provided by DECC
- Spreadsheet "Mott MacDonald data 010711.xls" provided by DECC
- Spreadsheet "EY and Arup data 010711.xls" provided by DECC
- Ofgem spreadsheet "Feed in Tariffs monthly update to June 2011.xlsx" provided by DECC
- Ofgem spreadsheet "Feed-in Tariff Installation Report 30 June 2011.xlsx", downloaded 14th July 2011
- "Review of the generation costs and deployment potential of renewable electricity technologies in the UK", Arup for DECC, June 2011
- "World Energy Outlook 2010", IEA, November 2010
- "Digest of UK Energy Statistics", DECC, 2010

Wind

General list above, plus:

- "Global Wind Energy Outlook 2010, Greenpeace/GWEC, October 2010
- Informal quotes and on-line prices from a number of wind turbine suppliers, July-October 2011, e.g. www.futurenergy.co.uk, www.provenenergy.co.uk, www.myriadceg.com, www.ampair.com, www.coemiwindturbines.co.uk, www.wirefreedirect.com
- Discussions with potential wind aggregators, July 2011
- Cost data from SME's provided by DECC, November 2011

Hydro

General list above, plus:

- "Opportunity and environmental sensitivity mapping for hydropower in England and Wales", Environment Agency, 2010
- "Analysis of Renewables Growth to 2020", AEA for DECC, March 2010
- Data on two specific hydro projects received from DECC, July 2011

- "Hydro Feed In Tariff - Industry evidence for 2011 review and transitional arrangement proposal transitional arrangement proposal", BHA March 2011, received from DECC

Micro-CHP

- "MicroCHP Accelerator Interim Report", Carbon Trust, November 2007
- "Micro-CHP (Combined Heat & Power) Accelerator - Final report (CTC788)", Carbon Trust, March 2011
- Informal discussions with suppliers of Stirling engine and fuel cell micro CHP units, July-November 2011
- "DOE Hydrogen Program 2010 Annual Progress Report", US Department of Energy, February 2011
- Baxi microCHP unit data, accessed on www.tenalpsevents.com/ContentFiles/1535%20MARTIN%20COFFEY.ppt
- http://www.inspiritenergy.com/producttechnology.html

Anaerobic Digestion

General list above, plus:

- "Anaerobic Digestion Strategy and Action Plan", DEFRA, 2011
- Data supporting the June 2011 Fast Track review of farm-scale AD, provided by DECC
- "Analysis of characteristics and growth assumptions regarding AD biogas combustion for heat and biomethane production and injection to the grid", SKM for DECC, December 2010
- Spreadsheet "DECC RHI cost database 23 12 10 v17 maize SH figures 1.xlsx", provided by DECC
- "Gate Fees Report 2011 - Comparing the cost of alternative waste treatment options", WRAP, July 2011
- "Partial Financial Impact Assessment of the introduction of a Quality Protocol for the production and use of anaerobic digestate", WRAP/EA, February 2009
- "AD plants – size of operational and planned plants.xlsx", data provided by DECC, November 2011
- Data on load factors of AD plants under RO, provided by DECC, November 2011

ANNEX B: DATA TABLES

Table B.1: Technology sizes

Technology	Size	Low	Medium	High
CHP	Domestic Stirling	1.0	1.0	1.0
CHP	Domestic Fuel Cell	1.0	1.0	1.0
Wind	B-M <1.5kW urban	0.9	1.0	1.3
Wind	B-M <1.5kW rural	0.9	1.0	1.3
Wind	M-M urban			
Wind	M-M rural			
Wind	1.5–15kW urban	5.0	6.0	10.0
Wind	1.5–15kW rural	5.0	6.0	10.0
Wind	15–50kW urban	15	20	30
Wind	15–50kW rural	15	20	30
Wind	50–100kW	55	60	75
Wind	100–500kW	200	350	450
Wind	500–1,500kW	800	1,300	1,400
Wind	1,500-5,000kW	1,500	2,000	2,500
Wind	Aggregators <500kW	350	450	500
Wind	Aggregators <1500kW	1,000	1,300	1,500
Hydro	<15kW	3	5	8
Hydro	15–50kW	20	23	30
Hydro	50–100kW	55	60	75
Hydro	100–1,000kW	350	500	650
Hydro	1,000–2,000kW	1,250	1,500	1,750
Hydro	2,000–5,000kW	2,500	3,500	4,500
Waste	AD > 500kW	1,300	1,800	2,200
Waste	AD 250 - 500kW	375	420	480
Waste	AD < 250kW	60	100	130

Table B.2: Export fraction (percentage of output exported to grid)

Technology	Size	Low	Medium	High
CHP	Domestic Stirling	10.0	50.0	90.0

Technology	Size	Low	Medium	High
CHP	Domestic Fuel Cell	10.0	50.0	90.0
Wind	B-M <1.5kW urban	0.0	5.0	10.0
Wind	B-M <1.5kW rural	0.0	5.0	10.0
Wind	1.5–15kW urban	20.0	30.0	75.0
Wind	1.5–15kW rural	50.0	50.0	75.0
Wind	15–50kW urban	20	50	80
Wind	15–50kW rural	50	75	90
Wind	50–100kW	20	50	80
Wind	100–500kW	50	90	95
Wind	500–1,500kW	50	90	99
Wind	1,500-5,000kW	50	90	99
Wind	Aggregators <500kW	50	90	99
Wind	Aggregators <1500kW	50	90	99
Hydro	<15kW	60	75	80
Hydro	15–50kW	80	95	100
Hydro	50–100kW	80	99	100
Hydro	100–1,000kW	90	99	100
Hydro	1,000–2,000kW	90	99	100
Hydro	2,000–5,000kW	90	99	100
Waste	AD, >500kW	85	87	90
Waste	AD, 250 - 500kW	80	85	90
Waste	AD < 250kW	60	80	90

Table B.3: Technology Lifetime Years

Technology	Size	Low	Medium	High
CHP	Domestic Stirling	8	10	15
CHP	Domestic Fuel Cell	4	5	7
Wind	B-M <1.5kW (urban & rural)	10	15	25
Wind	All other Wind types	15	20	25
Hydro	All Hydro types	25	25	25
Waste	All AD	15	20	25

Table B.4: Cumulative Installed Capacity, installed by tariff band, kW

Technology	Size	2010
Anaerobic digestion	<=250kW	140
Anaerobic digestion	250-500kW	0
Anaerobic digestion	>500kW	1,626
Hydro	<=15 kW	285
Hydro	>15-100kW	848
Hydro	>100kW-2MW	7,024
Hydro	>2-5MW	0
MicroCHP pilot	<=2kW	98
Wind	<=1.5kW	7
Wind	>1.5-15kW	4,475
Wind	>15-100kW	1,693
Wind	>100-500kW	495
Wind	>500kW-1.5MW	7,500
Wind	>1.5-5MW	0
Existing (transferred from RO)		14,260
Total		**38,451**

Table B.5: Cumulative Installed Capacity, installed by tariff band, number

Technology	Size	2010
Anaerobic digestion	<=250kW	1
Anaerobic digestion	250-500kW	0
Anaerobic digestion	>500kW	2
Hydro	<=15 kW	54
Hydro	>15-100kW	20
Hydro	>100kW-2MW	9
Hydro	>2-5MW	0
MicroCHP pilot	<=2kW	98
Wind	<=1.5kW	5
Wind	>1.5-15kW	515
Wind	>15-100kW	57
Wind	>100-500kW	2
Wind	>500kW-1.5MW	9
Wind	>1.5-5MW	0
Existing (transferred from RO)		3,674
Total		**4,446**

Table B.6: Fuel price

Technology	Size	Domestic	Commercial building	Developer	Utility
CHP	Domestic Stirling	domestic	industrial	industrial	industrial
CHP	Domestic Fuel Cell	domestic	industrial	industrial	industrial
CHP	Gas Engine (10kW)	domestic	industrial	industrial	industrial
CHP	Gas Engine (25kW)	domestic	industrial	industrial	industrial
Wind	B-M <1.5kW urban	domestic	industrial	industrial	industrial
Wind	B-M <1.5kW rural	domestic	industrial	industrial	industrial
Wind	M-M urban	domestic	industrial	industrial	industrial
Wind	M-M rural	domestic	industrial	industrial	industrial
Wind	1.5–15kW urban	domestic	industrial	industrial	industrial
Wind	1.5–15kW rural	domestic	industrial	industrial	industrial
Wind	15–50kW urban	domestic	industrial	wholesale	wholesale
Wind	15–50kW rural	domestic	industrial	wholesale	wholesale
Wind	50–100kW	domestic	industrial	wholesale	wholesale
Wind	100–500kW	domestic	industrial	wholesale	wholesale
Wind	500–1,500kW	domestic	industrial	wholesale	wholesale
Wind	1,500-5,000kW	domestic	industrial	wholesale	wholesale
Hydro	<15kW	domestic	industrial	wholesale	wholesale
Hydro	15–50kW	domestic	industrial	wholesale	wholesale
Hydro	50–100kW	domestic	industrial	wholesale	wholesale
Hydro	100–1,000kW	domestic	industrial	wholesale	wholesale
Hydro	1,000–2,000kW	domestic	industrial	wholesale	wholesale
Hydro	2,000–5,000kW	domestic	industrial	wholesale	wholesale
Waste	AD > 500kW	domestic	industrial	wholesale	wholesale
Waste	AD 250 - 500kW	domestic	industrial	wholesale	wholesale
Waste	<AD 250kW	domestic	industrial	wholesale	wholesale

Table B.7: Technology size band[6]

Technology	Size	Large or small
CHP	Domestic Stirling	small

[6] Used in calculation of supply chain constraints

Technology	**Size**	**Large or small**
CHP	Domestic Fuel Cell	small
Wind	B-M <1.5kW urban	small
Wind	B-M <1.5kW rural	small
Wind	1.5–15kW urban	small
Wind	1.5–15kW rural	small
Wind	15–50kW urban	small
Wind	15–50kW rural	small
Wind	50–100kW	small
Wind	100–500kW	small
Wind	500–1,500kW	large
Wind	1,500-5,000kW	large
Wind	Aggregators <500kW	large
Wind	Aggregators <1500kW	large
Hydro	<15kW	small
Hydro	15–50kW	small
Hydro	50–100kW	small
Hydro	100–1,000kW	large
Hydro	1,000–2,000kW	large
Hydro	2,000–5,000kW	large
Waste	AD >500kW	large
Waste	AD 250 - 500kW	small
Waste	AD < 250kW	small

Table B.8: Capital costs (fixed) by technology, in £, low case

Tech	Size	2010	2015	2020	2025	2030
CHP	Domestic Stirling	3,500	3,245	3,009	2,790	2,587
CHP	Domestic Fuel Cell	8,000	4,222	3,625	3,362	3,117
Wind	B-M <1.5kW urban	800	761	724	688	654
Wind	B-M <1.5kW rural	800	761	724	688	654
Wind	1.5–15kW urban	10,000	9,510	9,044	8,601	8,179
Wind	1.5–15kW rural	10,000	9,510	9,044	8,601	8,179
Wind	15–50kW urban					
Wind	15–50kW rural					
Wind	50–100kW					
Wind	100–500kW					
Wind	500–1,500kW					
Wind	1,500-5,000kW					
Wind	Aggregators <500kW					
Wind	Aggregators <1500kW					
Hydro	<15kW	6,000	5,706	5,426	5,160	4,907
Hydro	15–50kW	5,000	4,755	4,522	4,300	4,090
Hydro	50–100kW					
Hydro	100–1,000kW					
Hydro	1,000–2,000kW					
Hydro	2,000–5,000kW					

Waste	All					

Table B.9: Capital costs (marginal) by technology, in £ per kW, low case

Tech	Size	2010	2015	2020	2025	2030
CHP	All					
Wind	B-M <1.5kW urban	800	761	724	688	654
Wind	B-M <1.5kW rural	800	761	724	688	654
Wind	1.5–15kW urban	1,875	1,783	1,696	1,613	1,534
Wind	1.5–15kW rural	1,875	1,783	1,696	1,613	1,534
Wind	15–50kW urban	3,250	3,091	2,939	2,795	2,658
Wind	15–50kW rural	3,250	3,091	2,939	2,795	2,658
Wind	50–100kW	2,800	2,663	2,532	2,408	2,290
Wind	100–500kW	2,000	1,902	1,809	1,720	1,636
Wind	500–1,500kW	1,300	1,236	1,176	1,118	1,063
Wind	1,500-5,000kW	1,300	1,236	1,176	1,118	1,063
Wind	Aggregators <500kW	1,900	1,807	1,718	1,634	1,554
Wind	Aggregators <1500kW	1,225	1,165	1,108	1,054	1,002
Hydro	<15kW	3,000	2,853	2,713	2,580	2,454
Hydro	15–50kW	2,800	2,663	2,532	2,408	2,290
Hydro	50–100kW	2,800	2,663	2,532	2,408	2,290

Tech	Size	2010	2015	2020	2025	2030
Hydro	100–1,000kW	2,500	2,377	2,261	2,150	2,045
Hydro	1,000–2,000kW	2,000	1,902	1,809	1,720	1,636
Hydro	2,000–5,000kW	2,000	1,902	1,809	1,720	1,636
Waste	AD >500kW	2,500	2,377	2,261	2,150	2,045
Waste	AD 250 - 500kW	2,800	2,663	2,532	2,408	2,290
Waste	AD < 250kW	3,500	3,328	3,165	3,010	2,863

Table B.10: Capital costs (fixed) by technology, in £, medium case

Tech	Size	2010	2015	2020	2025	2030
CHP	Domestic Stirling	5,500	4,972	4,494	4,220	4,013
CHP	Domestic Fuel Cell	11,200	10,124	9,151	8,593	8,172
CHP	Gas Engines (10kW)					
CHP	Gas Engines (25kW)					
Wind	B-M <1.5kW urban	1,500	1,500	1,500	1,500	1,500
Wind	B-M <1.5kW rural	1,500	1,500	1,500	1,500	1,500
Wind	1.5–15kW urban	11,250	11,250	11,250	11,250	11,250
Wind	1.5–15kW rural	11,250	11,250	11,250	11,250	11,250
Wind	15–50kW urban					
Wind	15–50kW rural					
Wind	50–100kW					

Tech	Size	2010	2015	2020	2025	2030
Wind	100–500kW					
Wind	500–1,500kW					
Wind	1,500-5,000kW					
Wind	Aggregators <500kW					
Wind	Aggregators <1500kW					
Hydro	<15kW	12,000	12,000	12,000	12,000	12,000
Hydro	15–50kW	15,000	15,000	15,000	15,000	15,000
Hydro	50–100kW					
Hydro	100–1,000kW					
Hydro	1,000–2,000kW					
Hydro	2,000–5,000kW					
Waste	All					

Table B.11: Capital costs (marginal) by technology, in £ per kW, medium case

Tech	Size	2010	2015	2020	2025	2030
CHP	All					
Wind	B-M <1.5kW urban	2,000	2,000	1,950	1,902	1,855
Wind	B-M <1.5kW rural	2,000	2,000	1,950	1,902	1,855
Wind	1.5–15kW urban	2,250	2,250	2,194	2,140	2,087

Tech	Size	2010	2015	2020	2025	2030
Wind	1.5–15kW rural	2,250	2,250	2,194	2,140	2,087
Wind	15–50kW urban	3,500	3,500	3,413	3,329	3,246
Wind	15–50kW rural	3,500	3,500	3,413	3,329	3,246
Wind	50–100kW	3,250	3,250	3,170	3,091	3,015
Wind	100–500kW	2,500	2,500	2,438	2,378	2,319
Wind	500–1,500kW	2,000	2,000	1,950	1,902	1,855
Wind	1,500-5,000kW	1,750	1,750	1,707	1,664	1,623
Wind	Aggregators <500kW	2,300	2,300	2,243	2,188	2,133
Wind	Aggregators <1500kW	1,900	1,900	1,853	1,807	1,762
Hydro	<15kW	4,950	4,950	4,950	4,950	4,950
Hydro	15–50kW	4,750	4,750	4,750	4,750	4,750
Hydro	50–100kW	4,250	4,250	4,250	4,250	4,250
Hydro	100–1,000kW	3,200	3,200	3,200	3,200	3,200
Hydro	1,000–2,000kW	2,950	2,950	2,950	2,950	2,950
Hydro	2,000–5,000kW	2,500	2,500	2,500	2,500	2,500
Waste	AD > 500kW	4,500	4,172	3,968	3,870	3,774
Waste	AD 250 - 500kW	5,000	4,636	4,409	4,300	4,193
Waste	AD <250kW	6,000	5,563	5,291	5,160	5,032

Table B.12: Capital costs (fixed) by technology, in £, high case

Tech	Size	2010	2015	2020	2025	2030

Tech	Size	2010	2015	2020	2025	2030
CHP	Domestic Stirling	5,500	5,230	4,974	4,730	4,498
CHP	Domestic Fuel Cell	11,200	10,651	10,129	9,633	9,161
CHP	Gas Engines (10kW)					
CHP	Gas Engines (25kW)					
Wind	B-M <1.5kW urban	2,000	2,000	2,000	2,000	2,000
Wind	B-M <1.5kW rural	2,000	2,000	2,000	2,000	2,000
Wind	1.5–15kW urban	13,750	13,750	13,750	13,750	13,750
Wind	1.5–15kW rural	13,750	13,750	13,750	13,750	13,750
Wind	15–50kW urban					
Wind	15–50kW rural					
Wind	50–100kW					
Wind	100–500kW					
Wind	500–1,500kW					
Wind	1,500-5,000kW					
Wind	Aggregators <500kW					
Wind	Aggregators <1500kW					
Hydro	<15kW	13,000	13,663	14,360	15,093	15,862
Hydro	15–50kW	17,500	18,393	19,331	20,317	21,353
Hydro	50–100kW					
Hydro	100–1,000kW					

Tech	Size	2010	2015	2020	2025	2030
Hydro	1,000–2,000kW					
Hydro	2,000–5,000kW					
Waste	All					

Table B.13: Capital costs (marginal) by technology, in £ per kW, high case

Tech	Size	2010	2015	2020	2025	2030
CHP	All					
Wind	B-M <1.5kW urban	3,000	3,153	3,153	3,075	2,999
Wind	B-M <1.5kW rural	3,000	3,153	3,153	3,075	2,999
Wind	1.5–15kW urban	2,750	2,890	2,890	2,819	2,749
Wind	1.5–15kW rural	2,750	2,890	2,890	2,819	2,749
Wind	15–50kW urban	4,300	4,519	4,519	4,407	4,298
Wind	15–50kW rural	4,300	4,519	4,519	4,407	4,298
Wind	50–100kW	3,500	3,679	3,679	3,587	3,499
Wind	100–500kW	3,500	3,679	3,679	3,587	3,499
Wind	500–1,500kW	2,600	2,733	2,733	2,665	2,599
Wind	1,500-5,000kW	2,000	2,102	2,102	2,050	1,999
Wind	Aggregators <500kW	3,300	3,468	3,468	3,382	3,299
Wind	Aggregators <1500kW	2,450	2,575	2,575	2,511	2,449
Hydro	<15kW	6,500	6,832	7,180	7,546	7,931

Tech	Size	2010	2015	2020	2025	2030
Hydro	15–50kW	5,500	5,781	6,075	6,385	6,711
Hydro	50–100kW	10,000	10,510	11,046	11,610	12,202
Hydro	100–1,000kW	10,000	10,510	11,046	11,610	12,202
Hydro	1,000–2,000kW	8,000	8,408	8,837	9,288	9,762
Hydro	2,000–5,000kW	8,000	8,408	8,837	9,288	9,762
Waste	AD > 500kW	6,000	5,706	5,706	5,706	5,706
Waste	AD 250 - 500kW	7,000	6,657	6,657	6,657	6,657
Waste	AD <250kW	8,000	7,608	7,608	7,608	7,608

Table B.14: Operating costs (fixed) by technology, in £/ year, low case

Tech	Size	2010	2015	2020	2025	2030
CHP	Domestic Stirling	110	110	110	110	110
CHP	Domestic Fuel Cell	132	132	132	132	132
CHP	Gas Engines (10kW)					
CHP	Gas Engines (25kW)					
Wind	B-M <1.5kW urban	25	25	25	25	25
Wind	B-M <1.5kW rural	25	25	25	25	25
Wind	1.5–15kW urban	25	25	25	25	25
Wind	1.5–15kW rural	25	25	25	25	25
Wind	15–50kW urban					

Tech	Size	2010	2015	2020	2025	2030
Wind	15–50kW rural					
Wind	50–100kW					
Wind	100–500kW					
Wind	500–1,500kW					
Wind	1,500-5,000kW					
Wind	Aggregators <500kW					
Wind	Aggregators <1500kW					
Hydro	<15kW	300	300	300	300	300
Hydro	15–50kW	500	500	500	500	500
Hydro	50–100kW	5,000	5,000	5,000	5,000	5,000
Hydro	100–1,000kW	10,000	10,000	10,000	10,000	10,000
Hydro	1,000–2,000kW	25,000	25,000	25,000	25,000	25,000
Hydro	2,000–5,000kW	25,000	25,000	25,000	25,000	25,000
Waste	All					

Table B.15: Operating costs (marginal) by technology, in £ per kW, low case

Tech	Size	2010	2015	2020	2025	2030
CHP	All					
Wind	B-M <1.5kW urban					

Tech	Size	2010	2015	2020	2025	2030
Wind	B-M <1.5kW rural					
Wind	1.5–15kW urban					
Wind	1.5–15kW rural					
Wind	15–50kW urban	50	48	45	43	41
Wind	15–50kW rural	50	48	45	43	41
Wind	50–100kW	45	43	41	39	37
Wind	100–500kW	35	33	32	30	29
Wind	500–1,500kW	35	33	32	30	29
Wind	1,500-5,000kW	30	29	27	26	25
Wind	Aggregators <500kW	30	29	27	26	25
Wind	Aggregators <1500kW	30	29	27	26	25
Hydro	All					
Waste	AD > 500kW	800	800	800	800	800
Waste	AD 250 - 500kW	500	500	500	500	500
Waste	AD <250kW	550	550	550	550	550

Table B.16: Operating costs (fixed) by technology, in £, medium case

Tech	Size	2010	2015	2020	2025	2030
CHP	Domestic Stirling	120	120	120	120	120
CHP	Domestic Fuel Cell	144	144	144	144	144

Tech	Size	2010	2015	2020	2025	2030
CHP	Gas Engines (10kW)					
CHP	Gas Engines (25kW)					
Wind	B-M <1.5kW urban	50	50	50	50	50
Wind	B-M <1.5kW rural	50	50	50	50	50
Wind	1.5–15kW urban	80	80	80	80	80
Wind	1.5–15kW rural	80	80	80	80	80
Wind	15–50kW urban					
Wind	15–50kW rural					
Wind	50–100kW					
Wind	100–500kW					
Wind	500–1,500kW					
Wind	1,500-5,000kW					
Wind	Aggregators <500kW					
Wind	Aggregators <1500kW					
Hydro	<15kW	530	530	530	530	530
Hydro	15–50kW	3,175	3,175	3,175	3,175	3,175
Hydro	50–100kW	12,750	12,750	12,750	12,750	12,750
Hydro	100–1,000kW	31,750	31,750	31,750	31,750	31,750
Hydro	1,000–2,000kW	52,750	52,750	52,750	52,750	52,750
Hydro	2,000–5,000kW	52,750	52,750	52,750	52,750	52,750

Waste	All					

Table B.17: Operating costs by technology, in £ per kW, medium case

Tech	**Size**	**2010**	**2015**	**2020**	**2025**	**2030**
CHP	All					
Wind	B-M <1.5kW urban					
Wind	B-M <1.5kW rural					
Wind	M-M urban					
Wind	M-M rural					
Wind	1.5–15kW urban					
Wind	1.5–15kW rural					
Wind	15–50kW urban	75	73	71	70	68
Wind	15–50kW rural	75	73	71	70	68
Wind	50–100kW	60	59	57	56	54
Wind	100–500kW	50	49	48	46	45
Wind	500–1,500kW	50	49	48	46	45
Wind	1,500-5,000kW	45	44	43	42	41
Wind	Aggregators <500kW	45	44	43	42	41
Wind	Aggregators <1500kW	45	44	43	42	41
Hydro	All					

Waste	AD > 500kW	900	900	900	900	900
Waste	AD 250 - 500kW	750	750	750	750	750
Waste	AD <250kW	800	800	800	800	800

Table B.18: Operating costs (fixed) by technology, in £, high case

Tech	Size	2010	2015	2020	2025	2030
CHP	Domestic Stirling	130	130	130	130	130
CHP	Domestic Fuel Cell	156	156	156	156	156
CHP	Gas Engines (10kW)					
CHP	Gas Engines (25kW)					
Wind	B-M <1.5kW urban	100	100	100	100	100
Wind	B-M <1.5kW rural	100	100	100	100	100
Wind	1.5–15kW urban	200	200	200	200	200
Wind	1.5–15kW rural	200	200	200	200	200
Wind	15–50kW urban					
Wind	15–50kW rural					
Wind	50–100kW					
Wind	100–500kW					
Wind	500–1,500kW					
Wind	1,500-5,000kW					
Wind	Aggregators <500kW					
Wind	Aggregators <1500kW					

Hydro	<15kW	1,500	1,500	1,500	1,500	1,500
Hydro	15–50kW	5,000	5,000	5,000	5,000	5,000
Hydro	50–100kW	30,000	30,000	30,000	30,000	30,000
Hydro	100–1,000kW	60,000	60,000	60,000	60,000	60,000
Hydro	1,000–2,000kW	200,000	200,000	200,000	200,000	200,000
Hydro	2,000–5,000kW	200,000	200,000	200,000	200,000	200,000
Waste	All					

Table B.19: Operating costs by technology, in £ per kW, high case

Tech	Size	2010	2015	2020	2025	2030
CHP	All					
Wind	B-M <1.5kW urban					
Wind	B-M <1.5kW rural					
Wind	1.5–15kW urban					
Wind	1.5–15kW rural					
Wind	15–50kW urban	90	90	90	90	90
Wind	15–50kW rural	90	90	90	90	90
Wind	50–100kW	70	70	70	70	70
Wind	100–500kW	60	60	60	60	60
Wind	500–1,500kW	60	57	54	52	49

Tech	Size	2010	2015	2020	2025	2030
Wind	1,500-5,000kW	55	52	50	47	45
Wind	Aggregators <500kW	55	52	50	47	45
Wind	Aggregators <1500kW	55	52	50	47	45
Hydro	All					
Waste	AD > 500kW	1,100	1,100	1,100	1,100	1,100
Waste	AD 250 - 500kW	1,000	1,000	1,000	1,000	1,000
Waste	AD <250kW	1,000	1,000	1,000	1,000	1,000

Table B.20: CHP Load Factors

Site Type	Low	Medium	High
Domestic New Build	17%	23%	29%
Existing Domestic (Energy Efficient)	20%	26%	33%
Existing Domestic (Energy Inefficient)	26%	34%	43%
Stand-alone Commercial	29%	39%	49%
Stand-Alone Industrial	29%	39%	49%

Table B.21: Wind Load Factors

Site Type	Size	Low	Medium	High
5.5 m/s	B-M <1.5kW urban	2%	5%	13%
5.5 m/s	B-M <1.5kW rural	8%	10%	15%
5.5 m/s	1.5–15kW urban	2%	10%	13%

Site Type	Size	Low	Medium	High
5.5 m/s	1.5–15kW rural	10%	12%	15%
5.5 m/s	15–50kW urban	7%	11%	15%
5.5 m/s	15–50kW rural	13%	15%	16%
5.5 m/s	50–100kW	10%	13%	16%
5.5 m/s	100–500kW	10%	13%	25%
5.5 m/s	500–1,500kW	15%	20%	25%
5.5 m/s	1,500-5,000kW	15%	20%	25%
5.5 m/s	Aggregators <500kW	10%	13%	25%
5.5 m/s	Aggregators <1500kW	15%	20%	25%
6 m/s	B-M <1.5kW urban	2%	5%	16%
6 m/s	B-M <1.5kW rural	8%	12%	18%
6 m/s	1.5–15kW urban	2%	13%	17%
6 m/s	1.5–15kW rural	10%	17%	19%
6 m/s	15–50kW urban	7%	13%	15%
6 m/s	15–50kW rural	15%	16%	16%
6 m/s	50–100kW	16%	16%	21%
6 m/s	100–500kW	15%	18%	30%
6 m/s	500–1,500kW	20%	24%	30%
6 m/s	1,500-5,000kW	20%	24%	30%
6 m/s	Aggregators <500kW	15%	18%	30%
6 m/s	Aggregators <1500kW	20%	24%	30%

6.5 m/s	B-M <1.5kW urban	2%	8%	20%
6.5 m/s	B-M <1.5kW rural	8%	14%	23%
6.5 m/s	1.5–15kW urban	2%	15%	20%
6.5 m/s	1.5–15kW rural	12%	19%	23%
6.5 m/s	15–50kW urban	7%	17%	22%
6.5 m/s	15–50kW rural	19%	21%	24%
6.5 m/s	50–100kW	19%	22%	24%
6.5 m/s	100–500kW	19%	23%	35%
6.5 m/s	500–1,500kW	19%	25%	35%
6.5 m/s	1,500-5,000kW	19%	25%	35%
6.5 m/s	Aggregators <500kW	19%	23%	35%
6.5 m/s	Aggregators <1500kW	19%	25%	35%
7 m/s	B-M <1.5kW urban	2%	8%	24%
7 m/s	B-M <1.5kW rural	8%	14%	27%
7 m/s	1.5–15kW urban	2%	15%	24%
7 m/s	1.5–15kW rural	13%	23%	27%
7 m/s	15–50kW urban	7%	20%	26%
7 m/s	15–50kW rural	22%	25%	28%
7 m/s	50–100kW	23%	26%	28%
7 m/s	100–500kW	23%	26%	38%
7 m/s	500–1,500kW	23%	27%	38%

Site Type	Size	Low	Medium	High
7 m/s	1,500-5,000kW	23%	27%	38%
7 m/s	Aggregators <500kW	23%	26%	38%
7 m/s	Aggregators <1500kW	23%	27%	38%
7.5 m/s	B-M <1.5kW urban	2%	10%	28%
7.5 m/s	B-M <1.5kW rural	8%	16%	31%
7.5 m/s	1.5–15kW urban	2%	21%	28%
7.5 m/s	1.5–15kW rural	13%	25%	31%
7.5 m/s	15–50kW urban	7%	23%	29%
7.5 m/s	15–50kW rural	23%	25%	31%
7.5 m/s	50–100kW	23%	26%	31%
7.5 m/s	100–500kW	23%	28%	42%
7.5 m/s	500–1,500kW	23%	30%	42%
7.5 m/s	1,500-5,000kW	23%	30%	42%
7.5 m/s	Aggregators <500kW	23%	28%	42%
7.5 m/s	Aggregators <1500kW	23%	30%	42%
>8.0 m/s	B-M <1.5kW urban	2%	12%	31%
>8.0 m/s	B-M <1.5kW rural	2%	20%	34%
>8.0 m/s	1.5–15kW urban	2%	25%	31%
>8.0 m/s	1.5–15kW rural	14%	27%	34%
>8.0 m/s	15–50kW urban	7%	25%	32%

Site Type	Size	Low	Medium	High
>8.0 m/s	15–50kW rural	26%	27%	35%
>8.0 m/s	50–100kW	26%	32%	35%
>8.0 m/s	100–500kW	30%	32%	45%
>8.0 m/s	500–1,500kW	30%	32%	45%
>8.0 m/s	1,500-5,000kW	30%	32%	45%
>8.0 m/s	Aggregators <500kW	30%	32%	45%
>8.0 m/s	Aggregators <1500kW	30%	32%	45%

Table B.22: Hydro Load Factors

Site Type	Size	Low	Medium	High
All	All	30%	35%	45%

Table B.23: Waste Load Factors

Site Type	Size	Low	Medium	High
All	AD > 500kW	65%	80%	90%
All	AD 250 - 500kW	50%	65%	85%
All	AD < 250kW	30%	60%	85%

Table B.24: CHP, Technical Potential – MWh per year per site type, medium

CHP	Domestic New Build	Existing Domestic (Energy Efficient)	Existing Domestic (Energy Inefficient)	Stand-alone Commercial	Stand-Alone Industrial
Domestic Stirling		6,244,992	53,298,648	6,988,925	

CHP	Domestic New Build	Existing Domestic (Energy Efficient)	Existing Domestic (Energy Inefficient)	Stand-alone Commercial	Stand-Alone Industrial
Domestic Fuel Cell		693,888	5,922,072	776,547	

Table B.25: CHP, % Generation per investor types

Domestic	Commercial Building	Developer	Utility
88%	12%		

Table B.26: Wind, Technical Potential – MWh per year per site type, medium

Size	5.5 m/s	6 m/s	6.5 m/s	7 m/s	7.5 m/s	>8.0 m/s
B-M <1.5kW urban						
B-M <1.5kW rural	2,254,432	621,692	223,727	93,757	34,305	14,166
1.5–15kW urban						
1.5–15kW rural	867,576	413,834	179,828	80,606	38,665	29,445
15–50kW urban						
15–50kW rural	793,998	286,741	135,999	83,768	33,270	17,739
50–100kW	325,767	163,120	58,221	26,354	3,553	2,943
100–500kW	1,264,974	599,117	287,356	100,147	4,797	3,974
500–1,500kW	431,422	174,660	100,971	56,044	35,493	15,617
1,500-5,000kW	3,967,218	1,606,114	928,498	515,363	326,381	143,612
Aggregators <500kW	140,553	66,569	31,928	11,127	533	442
Aggregators <1500kW	47,936	19,407	11,219	6,227	3,944	1,735

Table B.27: Wind, % Generation per investor types

Size	Domestic	Commercial Building	Developer	Utility
B-M <1.5kW urban	80%	20%		
B-M <1.5kW rural	80%	20%		
1.5–15kW urban	20%	80%		
1.5–15kW rural	40%	60%		
15–50kW urban		100%		
15–50kW rural	10%	90%		
50–100kW		100%		
100–500kW			80%	20%
500–1,500kW			80%	20%
1,500-5,000kW			50%	50%
Aggregators <500kW			100%	
Aggregators <1500kW			100%	

Table B.28: Hydro, Technical Potential – MWh per year per site type, medium

Size	GB
<15kW	230,000
15–50kW	46,000
50–100kW	138,000
100–1,000kW	2,898,000
1,000–2,000kW	644,000
2,000–5,000kW	644,000

Table B.29: Hydro, % Generation per investor types

Size	Domestic	Commercial Building	Developer	Utility
<15kW	75%	25%		
15–50kW	5%	25%	70%	
50–100kW		10%	80%	10%
100–1,000kW			50%	50%
1,000–2,000kW			50%	50%
2,000–5,000kW			50%	50%

Table B.30: Waste, Technical Potential – MWh per year per site type, medium

Size	GB
AD > 500kW	1,600,000
AD 250 - 500kW	800,000
AD < 250kW	800,000

Table B.31: Waste, % Generation per investor types

Size	Domestic	Commercial Building	Developer	Utility
AD > 500kW			100%	
AD 250 - 500kW		20%	80%	
AD < 250kW		50%	50%	

Table B.32: Summary of proposed input hurdle rates

Investor type	Lower hurdle rate	Upper hurdle rate

Investor type	Lower hurdle rate	Upper hurdle rate
Households	1%	12%
Commercial property	5%	8%
Aggregators/ developers/ utilities	5%	8%