RENEWABLE ENERGY FOUNDATION

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Information Note

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The UK Feed-in-Tariff for Renewable Electricity:

Performance in the First Year, 2010-11

Summary

- Following a freedom of information request by the Renewable Energy Foundation (REF), and the release by Ofgem of data on the number, type and location of the generators subsidised under the feed-in-tariff (FiT) scheme, the Foundation has created a freely available on-line searchable database of these installations: www.ref.org.uk/fits.
- The data shows that growth in solar PV accounts for nearly all the increase in renewable microgeneration capacity, with other technologies showing only modest increases.
- The geographic location of favoured areas for solar PV includes concentrations in Sheffield, Barnsley, and Rotherham, suggesting that factors other than resource availability are driving adoption.
- The data also shows that the FiT scheme has resulted in a very substantial increase in the number of small solar PV installations, raising concerns about administration costs of the scheme and its overall cost-effectiveness.
- Using historical average annual load factors for the microgenerators in their appropriate size bands, we can see that the probable growth in actual output of renewable electricity is small. All of the FiTS generators installed at 31 March 2011 would generate approximately 140 GWh per annum. This represents 0.4% of the 38 TWh required to meet the 2010 target of 10% electricity from renewables.
- Government projects that the Feed-in-Tariff scheme will deliver 6 TWh of renewable electricity in 2020. Our figures suggest that this is ambitious and would require current output (as opposed to capacity) to increase more than 40 fold in 9 years.
- The costs of CO_2 abatement under the Feed-in-Tariff is very high, at more than £800 per tonne of CO_2 via subsidised small solar PV, compared with £46 per tonne of CO_2 abated by co-firing biomass.

Introduction

The Feed-in-Tariff scheme, designed by the Government to incentivise small-scale renewable electricity generation, commenced on the 1st of April 2010. Generators of less than 5 MW installed capacity are eligible, and the following technologies are supported: anaerobic digestion, small hydro, small combined heat and power generators, solar photovoltaic, and small wind turbines. There are 22 tariff bands ranging from 9p/kWh to 44.3p/kWh, with an extra potential of approximately 3p/kWh being negotiable for the fraction of generated electricity exported to the grid.

Following a Freedom of Information (FoI) request by REF in December 2010, Ofgem agreed to publish, on a quarterly basis, data on registered FiTs installations and levelisation payments. The precise location of the individual FiTs installations is withheld, to protect personal privacy, but the left-most part of the postcode of each installation has been released, so that it is possible to gain some insight into the geographic distribution of registered generators.

Data on the quantities of energy actually generated by each installation over a period is not collected by Ofgem, a point that REF has criticized as frustrating any attempt by government or the public to assess value for money from the Feed-in Tariff scheme and efficacy in meeting climate change targets.[1]

1. New, searchable, FiTS database available from REF website

Using the raw data released by Ofgem, REF has created a searchable database of the small scale renewable generators subsidised via the FiT scheme. This is published on the REF website and is available without charge. As far as possible, the listing follows the conventions of REF's existing database of large scale renewable energy generators subsidised via the Renewables Obligation. Both databases can be accessed via:

http://www.ref.org.uk/energy-data

2.The Feed-in Tariff and Generation Capacity Increases

Figure 1, below, shows that growth in installed capacity has occurred predominantly in solar photovoltaics, whereas growth in small scale wind has been modest, and growth in small scale hydro still less significant.

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[1] http://www.ref.org.uk/press-releases/216-missing-fit-data-makes-value-checking-impossible

The installed capacity of the FiT-supported generators is small compared with that of large RO subsidised generators. For example, FiT-subsidised wind has an installed capacity of 19 MW compared with the 5,000 MW of large scale wind. Similarly, there are 11 MW of hydro registered under the FiT scheme compared with the 600 MW of large hydro generators remaining in the Renewables Obligation scheme post April 2010.[2]

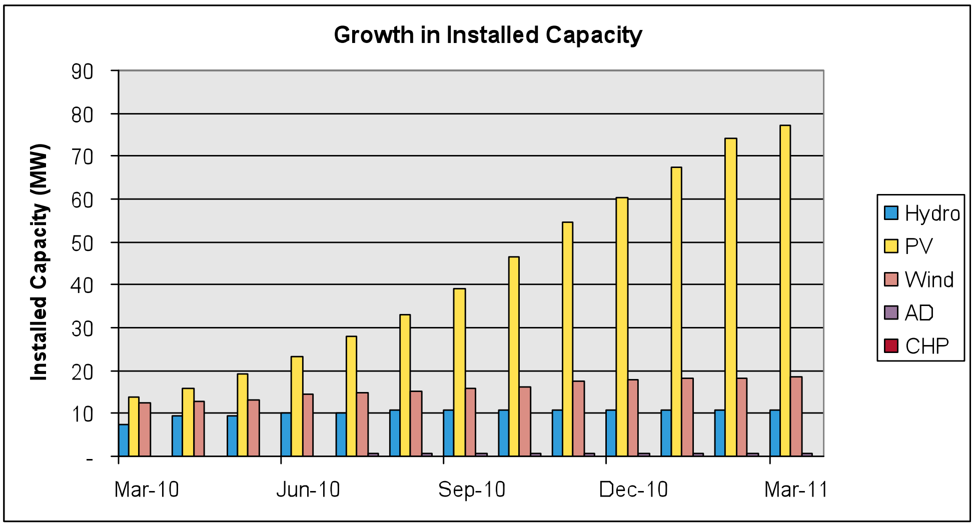

Figure 1: Growth in Installed Capacity of FiT generators. Source: REF calculations from Ofgem data.

3. Geographic distribution

Unsurprisingly, the geographic distribution of the installed capacity in Figure 2 shows that small-scale hydro is clustered in Scotland and Wales. Small-scale wind generation is also predominantly concentrated in Scotland.

It is interesting to note that solar PV has been installed at a substantial numbers of sites in all regions of the UK, including the far north of Scotland. As would be anticipated on grounds of resource availability, the majority of these sites are located in the south west and south east of England, but nonetheless, there is a significant quantity of solar PV installed in Yorkshire and Humberside. Examination of the data shows that 1.4 MW of PV is installed in each of Barnsley, Sheffield, and Rotherham. These concentrations suggest that factors other than resource availability are driving adoption, for example well-designed and targeted marketing

[2] This total does not include the 100 MW Glendoe hydro station which has been out of commission since September 2009.

campaigns. The actual causes of the Yorkshire and Humber concentrations are not known to us.

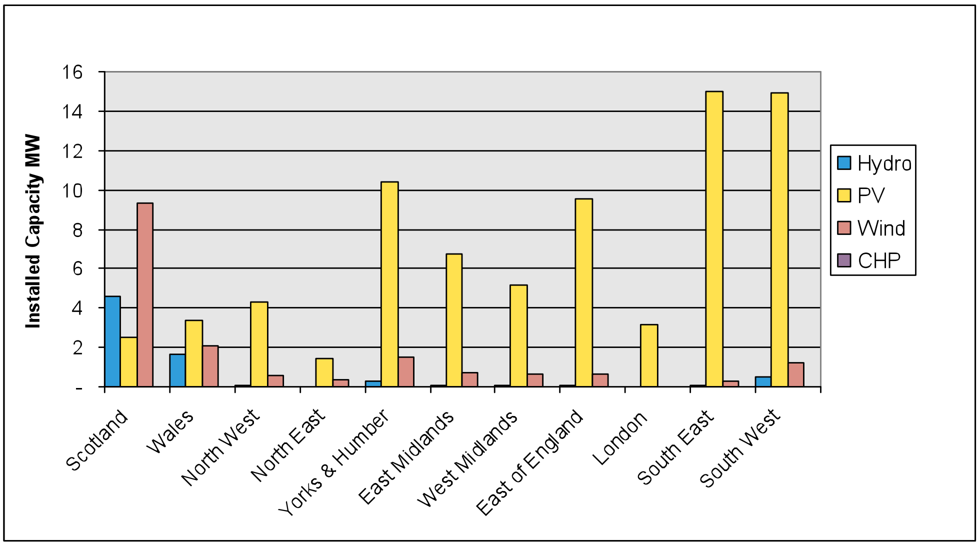

Figure 2: Geographic Distribution of FiT registered microgeneration. Source: REF calculations from Ofgem data.

The following map shows the distribution of Ofgem-accredited solar PV in the UK as at 31 March 2011. Each blue circle represents the installed capacity in one postcode area at the resolution available to us, namely the leftwards portion only (e.g. WC2N), and is located in the approximate centre of that area. The area of the blue circles is proportional to the installed capacity in that postcode area.

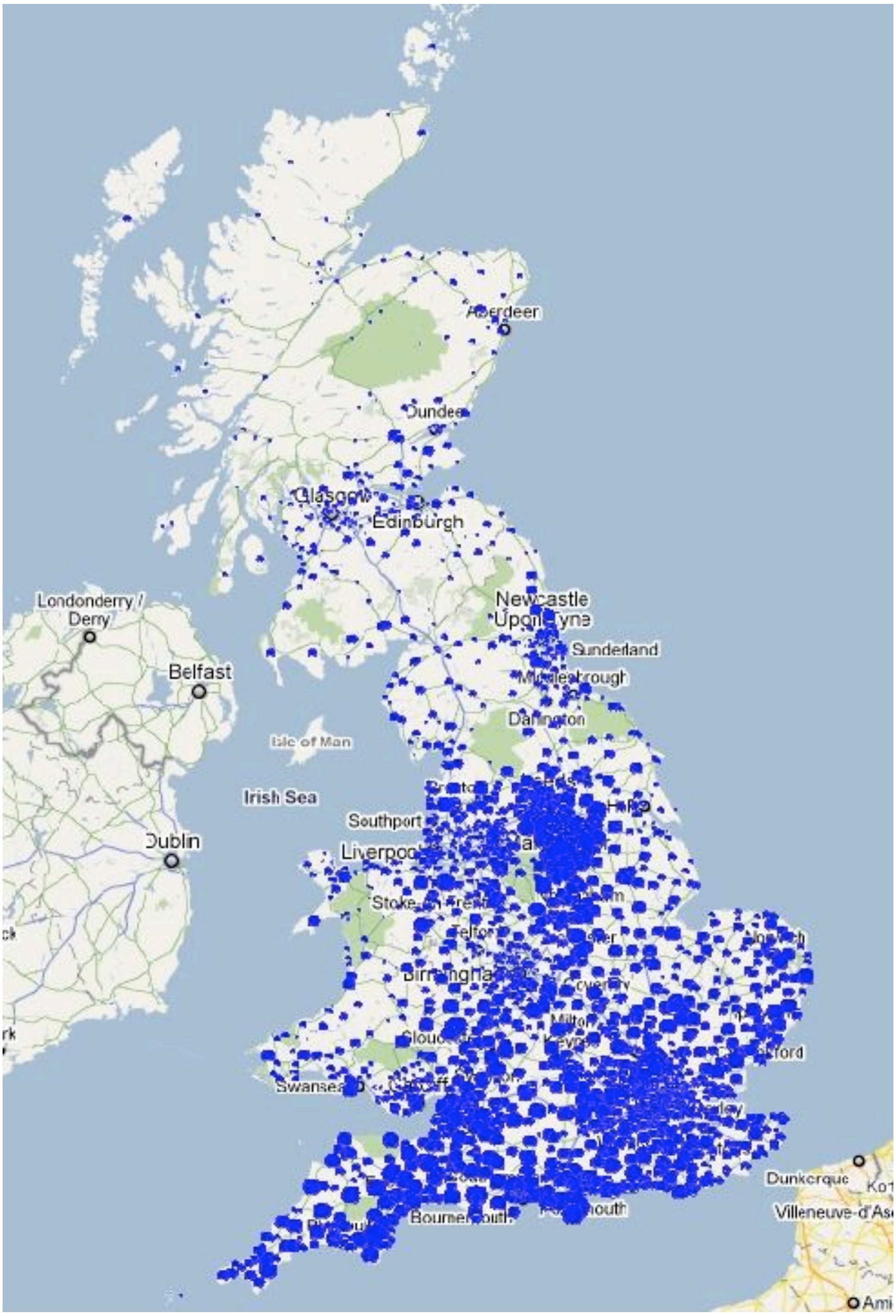

Figure 3: Density distribution Feed-in Tariff registered solar photovoltaic generation in the United Kingdom at 31 March 2011. Each blue circle represents the installed capacity in one postcode area at the resolution available to us, namely the leftwards portion (e.g. WC2N), and is located in the approximate centre of that area. The area of the blue circles is proportional to the installed capacity in that postcode area. Source: REF charting, from Ofgem data.

4. Actual generation data is unavailable but has been estimated by REF

Under the Renewables Obligation, monthly electricity generated data is available in the public-domain for every RO accredited generator. REF reprocesses this raw data and makes it available on its website. However, the FiT scheme does not require the collection of such information at the level of individual generator, or for its publication or release to government.[3] While some part of this information is known by the FiT licensees,[4] they are not required to provide generation data at this low level to Ofgem. REF believes that this failure to disclose output from subsidized generators should be corrected, since the flow of information on technology performance, facilitates market learning and is one of the key arguments in favour of public subsidy for renewables.

Fortunately, historic data does exist for some of those FiT subsidised generators originally registered under the Renewables Obligation. However, this data is not available for many of the smallest generators because their output was managed by agents who aggregated the total output from their portfolio of clients and made only a single annual claim for Renewables Obligation Certificates.

Another source of data available from Ofgem is Renewable Energy Guarantee of Origin (REGO) information. REGOs are also certificates issued for renewable electricity generated, and are used to comply with an EU requirement and facilitate the mandatory reporting of Fuel Mix by electricity suppliers. Ofgem manages the issuing and register of the REGO certificates in the same way as it does the Renewable Obligation Certificates. Until the 5th of December 2010, one REGO was issued for every kilowatt hour of renewable energy generated, but since that date, the regulations have changed so that one REGO is issued per megawatt hour.

There is much more REGO-based data for the small generators than ROC data, and the period when one REGO was equal to 1 kWh is at a usefully fine level of granularity to enable reasonable accuracy in determining annual load factors. We have used the REGO data to

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[3] http://www.ref.org.uk/press-releases/216-missing-fit-data-makes-value-checking-impossible

[4] FiT licensees are the organisations tasked with registering FiT generators, taking regular meter readings and making FiT payments to the generator. Licensed electricity suppliers with 50,000 or more customers are mandatory FiT licensees. There are also additional organisations which have volunteered to become FIT licensees. For more information see http://www.ofgem.gov.uk/Sustainability/Environment/fits/Pages/fits.aspx.

determine average annual load factors for the small generators, as listed in the table below. The load factors are given for each of the FiT subsidy bands, and we have only included generators where complete year's of generation data is available. The Ofgem accounting year, which runs from April to March, is used in this analysis, so that the latest available data is the year ending March 2010.

Table 1: Average Annual Load Factors derived from REGO data for Small Renewable Generators

Hydro

Band	Average Annual Load Factor	Standard Deviation
0-15 kW	36%	21%
15-100 kW	53%	18%
100- 2,000 kW	40%	18%

PV

Band	Average Annual Load Factor	Standard Deviation
0-4 kW	10%	3%
4-10 kW	9%	2%
10 -100 kW	7%	3%
100- 5,000 kW	6%	

Wind

Band	Average Annual Load Factor	Standard Deviation
0-1.5 kW[5]	13%	
1.5-15 kW	13%	9%
15- 100 kW	13%	11%
100- 500 kW	18%	7%
500- 1500 kW	26%	8%

There is, as yet, only a limited amount of data available for small AD plants, and while we estimate that a load factor of 50% is a reasonable assumption for such plants, we continue to seek empirical confirmation for this figure.

It is important to note that the load factors for small hydro vary over a wide range, and it is clear that further work could usefully be done on revealing the underlying causes of this matter. It is also interesting to note that larger solar installations seem to have lower load

[5] There is insufficient coverage of data for this band, so we have arbitrarily used the load factor for the next band up in size.

factors than small installations, a counterintuitive finding. One possible explanation is that this is a statistical anomaly arising from the fact that there are relatively few of these sites, which just happen to be poor, but an examination of aerial photographs shows that these sites include some with roof-mounted solar panels that are often installed in ways that fail to maximize orientation to the south. It is possible that early installers did not appreciate the importance of achieving optimal orientation to maximize returns.

Using the load factors derived from the REGO data, and the installed capacities published in the FiT register, it is possible to make a reasoned estimate of the quantities of renewable electricity generated, and this is illustrated in the following figure. Readers should note that the chart is based on average **annual** load factors, so seasonal variations have been smoothed out. This is a limitation of the data available to us.

Nevertheless, the information provides a useful insight, and clearly demonstrates that the higher average annual load factor of small hydro results in an energy contribution disproportionate to the installed capacity plotted in Figure 1, above. Encouraging further growth in small hydro would seem to be a sensible strategy for government.

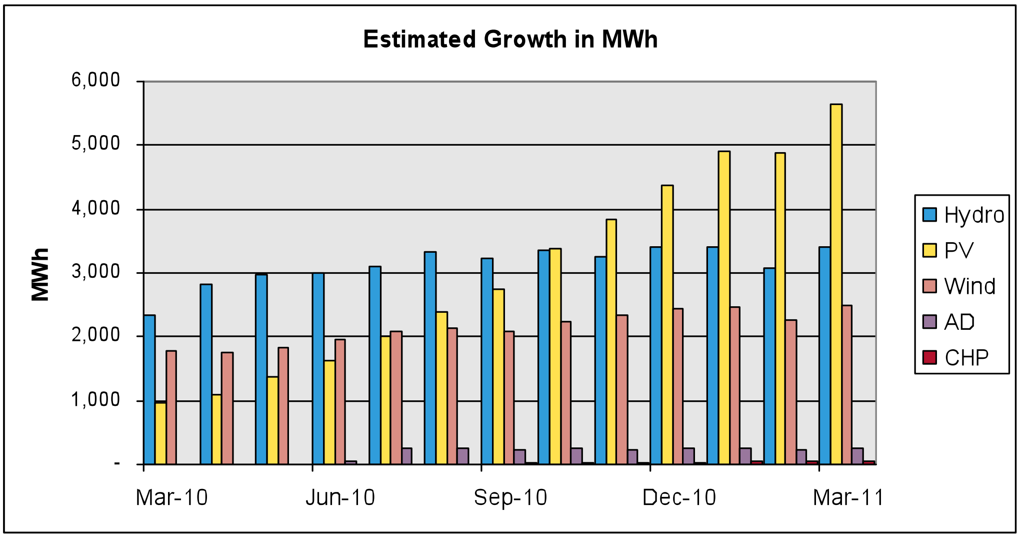

Figure 4: Estimated energy generation from feed-in tariff registered generators, March 2010 to March 2011. Note that the output is estimated on the basis of annualized load factors (the only data available), so that seasonal variations have been smoothed out.

5. Growth in numbers of Installations

There has been very significant growth in the numbers of installations, which has risen from approximately 6,000, at the beginning of the scheme, to 24,000 at the end of the first year.

Most of this growth has been in solar PV installations. Effective management of this number of sites is likely to be substantial, and REF has received anecdotal evidence that adopters are experiencing administrative difficulties in registering their generators with the relevant FIT licensees.

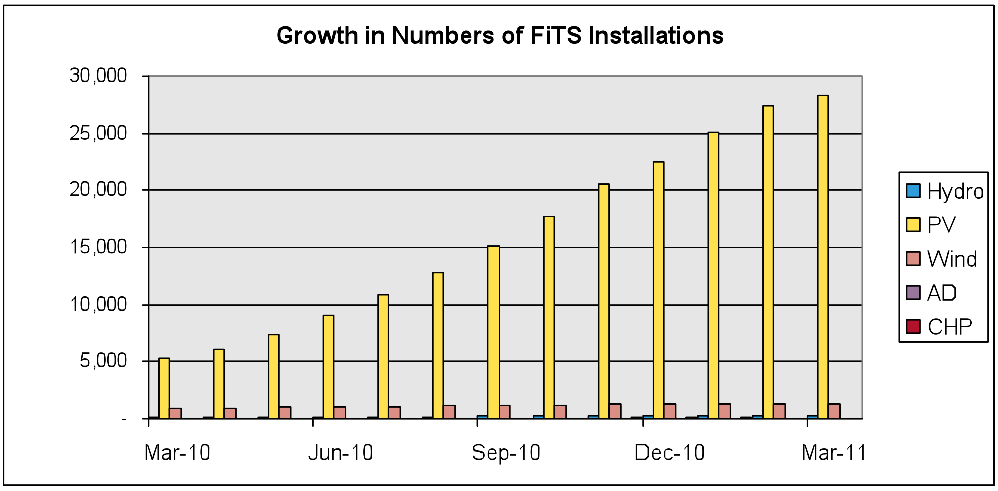

Figure 5: Cumulative numbers of generation sites registered under the Feed-in Tariff, March 2010 to March 2011. Source: REF calculations from Ofgem data.

6. FiT contribution toward targets

The overall contribution of the current FiTs generators towards the renewable targets is modest. By our estimates, all of the FITS generators installed at 31 March 2011 would generate approximately 140 GWh per annum. This represents 0.4% of the 38 TWh required to meet the target of 10% electricity from renewables in 2010, and 0.6% of the 25 TWh which actually was generated by renewables in that year.[6]

The Government projects that the Feed-in-Tariff scheme will deliver 6 TWh of renewable electricity in 2020.[7] Our figures suggest that this is ambitious and would require current output to increase more than 40 fold in 9 years.

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[6] See http://www.ref.org.uk/publications/229-renewables-output-in-2010

[7] See DECC, *Impact Assessment of Feed-in Tariffs for Small-Scale, Low Carbon, Electricity Generation* (01.02.10) (URN10D/536), available from:

http://www.decc.gov.uk/assets/decc/Consultations/Renewable%20Electricity%20Financial%20Incentives/1_20100204103559_e_@@_FITsImpactAssessmentaccompanyingGovernmentResponse.pdf

7. Costs of the Feed-in Tariff scheme and costs of CO_2 Abatement under the scheme

One of the Government's stated objectives for the FiT scheme is to increase awareness of renewable energy generation among the general public,[8] and it seems likely from the data presented above that the scheme is successful as a consciousness-raising exercise. However, the FiT is both costly to the consumer in absolute terms, and is also an expensive emissions abatement mechanism.

The FiTs Impact Assessment carried out by DECC estimates the cost of the Feed-in-Tariff to 2030 at £8.6 billion contrasting with monetised benefits including carbon savings at £420 million. Thus, the net cost of the FiT to 2030 is £8.2 billion.[9]

With regard to costs of emissions abatement, the following table compares a selection of these costs under both the Renewables Obligation and the Feed-in-Tariff scheme.[10] The range in costs given for the FiTs data arises because different tariffs apply for different sizes of generator.

Table 2. Emissions abatement costs under the Renewables Obligation and the Feed-in Tariff

Subsidy Mechanism and Technology	**Cost: £/tonne CO_2**
RO – co-firing	£46
RO – Onshore wind	£93
RO – Offshore wind, Anaerobic Digestion	£185
FiTs – Anaerobic Digestion	£174 - £224
FiTs – Hydro	£167 - £387
FiTs – Wind	£167 - £671
FiTs – PV	£167 - £803

Any consideration of consumer burden of supporting the feed-in tariff should also recognize the committed on-costs of present policies, an approach employed for example in the

[8] See, for example, the policy objectives in DECC, *Impact Assessment of Feed-in Tariffs for Small-Scale, Low Carbon, Electricity Generation* (URN10D/536), 3.

[9] DECC, *Impact Assessment of Feed-in Tariffs for Small-Scale, Low Carbon, Electricity Generation* (URN10D/536), 2.

[10] This assumes a ROC is worth £50 per MWh. No allowance is made in the FiT figures for the extra subsidy allowed for exported electricity. The value of 0.54 kg CO2 per kWh of electricity used comes from DEFRA's guidance on reporting greenhouse gas emissions. See http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/

following figure, from work by Frondel et al, which the shows the annual costs extending for 20 years of subsidy payments due for the solar PV installed in Germany up to 2009.

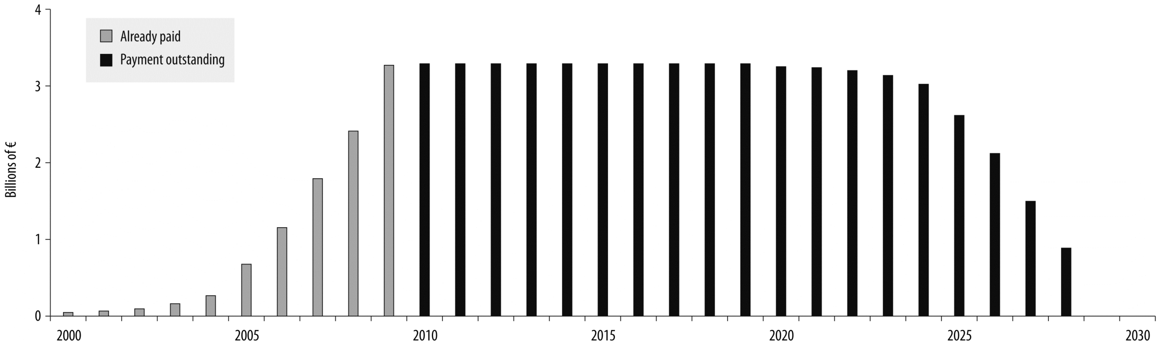

Figure 6: Annual amount of feed-in tariffs for PV modules installed between 2000 and 2009. Source: 'Economic Impacts from the Promotion of Renewable Energies' (2010). Source: Redrawn from Frondel, M., Ritter, N., Schmidt, C. M., Vance, C, 'Economic Impacts from the Promotion of Renewable Energies: The German Experience', *Energy Policy* 38 (2010), 4051.

The cost to 2010 is €13bn, but the as yet unpaid oncost to 2027 amounts to over €50bn. Heavy backloading of this kind is also characteristic of the United Kingdom's policies, and raises questions over the long-term sustainability of policies implying such significant increases in consumer costs.

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