The impact of the UK governments spending review into the Feed in Tariff (FIT) on the installation on photovoltaic panels in the residential sector

Amira Elnokaly and Benjamin A.J. Martin
School of Architecture, University of Lincoln, Lincoln, UK

Abstract

Purpose – In October 2011 the Government brought in measures to reduce the revenue provided by the Feed in Tariff (FIT) system. This change came under a lot of opposition due to the potential affects that it would have upon the industry. The purpose of this paper is to explore the potential benefits of the FIT and the impact that the Governments Comprehensive Spending Review had upon the industry and its uptake by the householders.

Design/methodology/approach – For the study and to calculate the benefits of the FIT, a predictive modelling tool was built that could calculate the potential income and savings for a household. A photovoltaic (PV) installation was then monitored for over a year and the results of the predictive modelling tool were compared to actual results produced from the system to show how accurate the modelling tool was. The impacts of the Governments comprehensive spending review and the potential impacts in the industry were then calculated and discussed.

Findings – The FIT is still a good incentive for people investing in PV. However, the reduction in the FIT may impact the "Rent a Roof" system and this in turn will impact most heavily on lower income families. The research also concluded that the changes in the political agenda have had a major impact on the FIT for both the industry and the community. Thus, the solar FITs will continue to be an attractive incentive in place to pay for heating through renewable means and thus ensuring reducing the own carbon footprint. Concomitantly, well-developed ownership schemes need to be put in place.

Originality/value – The reduction in the FIT was the right move by the Government as it should prevent the increase in energy bill prices which will affect the people without PV at this point in time. It also has been set so that it is still generous enough to encourage the industry and stimulate installation as there is still profit but not in a way that should put people off. The UK may just have to take time to realise that the FITs are still a good deal after the very generous tariff that preceded them.

Keywords Renewable energy, Technology adoption, Energy calculation tool, Feed in Tariff (FIT), Photovoltaic (PV), Rent a roof

Paper type Research paper

1. Introduction

In April 2010 the UK Government implemented a Feed in Tariff (FIT) scheme to promote the use of renewable energy and encourage the installation of renewable technology (Walker, 2012). Technologies such as wind energy and solar photovoltaic (PV) have seen significant growth in recent years throughout the world (Ho *et al.*, 2004). By using the experience of FIT schemes in other countries such as Germany (Butler and Neuhoff, 2008; Wand and Leuthold, 2011), the UK Government wanted to implement a similar tariff to encourage growth in sustainable energy technologies in order to reduce the country's dependency on fossil fuel and to meet its targets in reducing carbon emissions by 80 per cent by 2050 (Strachan *et al.*, 2011).

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The scheme proved a major success (Department of Energy and Climate Change (DECC), 2011a) with thousands of PV installations taking place over time. This was up taken not only by smart homes and businesses, but also by the wider community with the notion of maximising the use of energy resources at times of abundance. However, over time the Government realised that the demand for the PV panels and their installations were growing to a point where the amount of money allocated to the FIT scheme was excessive for its needs (Department of Energy and Climate Change, 2011b). The Government went about its comprehensive review of the FIT with results published on 31 October 2011 (DECC, 2011a). This review reduced the FIT by up to 50 per cent of the original tariff resulting in dramatic effects on the industry. In response, some businesses took the Government to court as they believed the reduction was illegal (Carrington and Vaughan, 2012).

This study evaluates the impact of the British Governments review on the FIT system in the UK and analyses the potential effects of the reduction made to the FIT. The study also investigates the potential income and savings that PV can provide through the FIT system for an average household in the UK. The study uses a predictive modelling tool developed (by Ben Martin while working for Longhurst & Havelok Homes and developed further for this study) based upon a European Commission into solar radiation (European Commission (EC), 2011) to quantify the potential of PV installation under the old and new FIT. This modelling tool was further developed later in 2011 and was used as a modelling tool for this study.

2. PV panels and the FIT

2.1 PV panels

PV panels are a renewable technology that has become increasingly popular in recent years with the drive for Green technology and Governments' incentives throughout Europe and the world (del Río González, 2008). PV panels use the suns energy and the PV effect to create an electrical current in the form of direct current (Park *et al.*, 2009) and this is then converted into alternating current through a converter in the installation (Li *et al.*, 2011) so that the electricity produced can be used within buildings. PV panels can be used in a variety of configurations, the main being placed on the roof of a building (Bergamasco and Asinari, 2011), however ground mounted or built into purpose made frames are other options. The optimum placement for PV panels is to be placed on a directly south facing roof and at around 35° off horizontal to get the most sun exposure as possible throughout the day. The nearer to the equator that the panels are, the more sun exposure they will receive so in Europe and the UK it is more beneficial to have PV installations placed further south. However, having said this, the panels still have an effect in areas such as Northern Scotland and are still applicable for use.

The panels may also be used both in new design and retrofit projects. PV power plants can be created where thousands of panels are brought together to generate megawatts of power (EL-Shimy, 2009). When placed on an existing roof of the average house in the UK, providing it has a south facing roof, the PV panels can generate up to 50 per cent of the average annual consumption of that building (Ayompe *et al.*, 2010). This can be of a great saving on the average household's utility bill and potentially may prevent fuel poverty for that household (Saunders *et al.*, 2011).

One of the advantages of PV panels is that they are almost maintenance free. Due to the fact that the panels have no moving parts within them, there is very little erosion within the system (Lu and Yang, 2010). The converter within the system is however supposed to have a lifespan of around ten years as the device works constantly throughout its life. Most PV panels have nowadays a self-cleaning membrane on the outside which allows for rain to wash away the majority of the dirt depositing on them preventing the need for the panels to be cleaned regularly (He *et al.*, 2011). Due to this, PV panels rarely breakdown or require maintenance resulting in being highly reliable. Most PV panels will come with a 25-year guarantee to show this.

The Government and environmentalist are pushing forward to try and get people using renewable technologies with PV being at the forefront of this. Environmentalists also want the technology spread as it is one of the greenest technologies around producing electricity with zero carbon emissions and high reliability (Xing *et al.*, 2011). The UK Government agrees with this and sees this technology as a way of meeting the need for producing 20 per cent of the country's electricity by 2020 (Williges *et al.,* 2010). By doing so the country would have greener electricity from renewable sources and this would in turn bring down the reliance on fossil fuels and potentially reduction in utility bills.

There are numerous reasons for the UK Government for implementing its policy on the FIT and to encourage the use of green technologies in general and PV in particular. The first and foremost at the top of the UK Government's list is the fact that PV provides energy security for the future. The UK depends heavily on fossil fuels and nuclear power to provide its energy. With one quarter of its power stations likely to close in the next ten years, equating to 20 GW (Department of Energy and Climate Change, 2011d), the Government is looking at ways to replace this loss.

Fossil fuels are becoming increasingly expensive (Shafiee and Topal, 2009) and are likely to continue so with their price increase in the forthcoming years. This is also made worse as the UK imports most of its fossil fuels making the nation highly dependent on other countries. Add to this the environment impacts of fossil fuels and the carbon emissions that they create, renewable technologies provide a cleaner and cheaper method of electricity production which could back up the Government's potential plans for adding more nuclear power (Toke, 2011) (not clear more nuclear or less). Renewable technology could also provide the security that the UK Government requires for if more households were producing their own electricity whether partial or wholly, this would take pressure off the National Grid and allow the UK to move towards becoming self-sustaining with regards to its energy demands.

During this time of economic turmoil, the UK Government is looking to start the economy and using the FIT as an incentive for the industry to invest more money in PV schemes (Algieri *et al.*, 2011). This policy has been demonstrated around the globe through other incentive tariffs and there is evidence for a clear correlation between the introduction of the tariffs and the growth in the renewable market (Dinçer, 2011). Since the introduction of the FIT in April 2010, the UK has seen a massive growth in the PV industry resulting in reducing the price of PV panels as well as helping the economy.

Not only does the UK Government's policy on the FIT affects the industry but it also affects the way in which we live and act. As well as introducing the economic benefits to the public, FIT can also contribute to changing lifestyles with regards to reducing amounts of carbon emissions and increased awareness of the consequences of the energy use within homes (Zhang *et al.*, 2011). Studies have shown that in the UK the installation of a PV system upon a home encourages the home owner to reduce their electric consumption by up to 6 per cent, and also to start using electric appliances during times when the system will be producing the electricity needed (Keirstead, 2007). These benefits work for the Government in two ways. First, the reduction in electricity usage will allow for a decrease in carbon emissions which help the Government reach its carbon targets. The second benefit for the Government is that as home owners adapt to work with their renewable energy systems they will become less dependent on the National Grid and this in turn will improve energy security.

2.2 FIT

The FIT was introduced by Ed Miliband in his role as Secretary of State for Energy and Climate Change and the Labour Government in 2008 and finally came into effect in April 2010. Based around other countries' models (del Río González, 2008), these FIT's were introduced to provide an incentive for the population to take up PV and other renewable technologies such as anaerobic digestion, hydro and wind power. However, PV was the main emphasis for the Government and the tariffs represented this by being very generous as shown in Table I.

These tariff levels were very generous for the time as the average price of an electric unit was around 10 p/kWh. This meant that for creating an electrical unit, you would earn up to four times the amount it cost to purchase it off the National Grid. The FITs are index linked so the tariff will increase with inflation of energy prices. The Government has guaranteed that once you begin with your FIT and when the installation is complete, there is no way for the Government to reduce your tariff. The Government also guaranteed that the tariffs will last for 25 years, which is the usual guarantee on a PV installation. The export tariff was also set up with the scheme so that surplus electricity could be sold back to the National Grid. However, due to the fact that there is no current

Type	Size of system	Feed in tariff (p/kWh)
Anaerobic digestion biogas	⩽250 kW	11.5
Anaerobic digestion biogas	>250-500 kW	11.5
Anaerobic digestion biogas	>500-5 MW	9.0
Hydro power	⩽15 kW	19.9
Hydro power	>15-100 kW	17.8
Hydro power	>100-2 MW	11.0
Hydro power	>2-5 MW	4.5
Micro CHP	⩽2 kW	10.0
Solar PV	⩽4 kW new build	36.1
Solar PV	⩽4 kW retrofit	41.3
Solar PV	>4-10 kW	36.1
Solar PV	>10-50 kW	31.4
Solar PV	>50-100 kW	31.4
Solar PV	>100-150 kW	29.3
Solar PV	>150-250 kW	29.3
Solar PV	>250-5 MW	29.3
Solar PV	⩽5 MW standalone	29.3
Wind power	⩽1.5 kW	34.5
Wind power	>1.5-15 kW	26.7
Wind power	>15-100 kW	24.1
Wind power	>100-500 kW	18.8
Wind power	>500-1.5 MW	9.4
Wind power	>1.5-5 MW	4.5
All	Export tariff	3.0

Source: www.fitariffs.co.uk

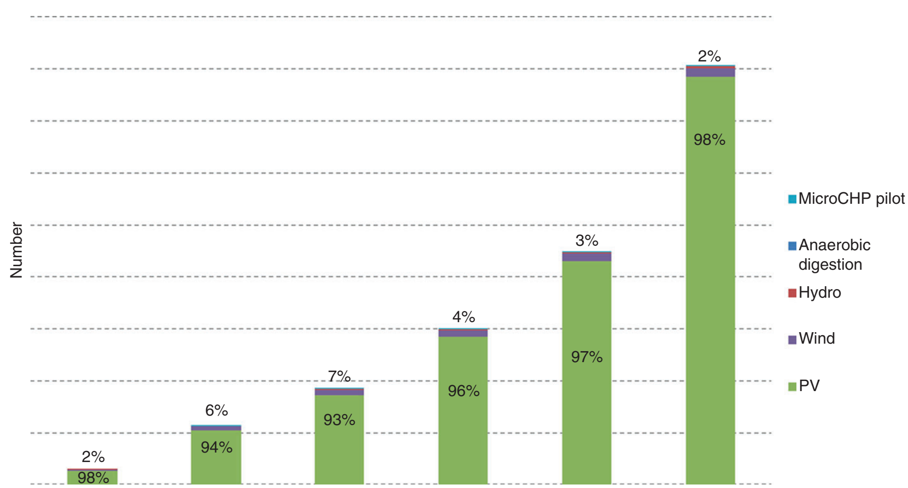
Table I. List of feed in tariff's released by the Government in April 2010 agreed way of measuring this, the export tariff is calculated at 50 per cent of the electricity produced by the system.

This would mean that if you were to install straight away, you would receive up to 41.3 p for every kWh you produce that would be index linked for 25 years as the agreement states. This initiative was quickly embraced and the amount of PV installations shot up since 2010. This is shown in Figure 1. The figure depicts the amount of PV installations against other renewable technologies on FIT and the dramatic increase of installations over time since the introduction of the tariff.

The FIT is not actually paid for out of the treasury but comes from the utility companies (DECC, 2011a). The Government has made the utility companies set aside money for renewable technologies to be used to pay for the FITs. However, to raise the finance needed for the scheme, the energy suppliers effectively increased the cost of their energy provided to pay for the schemes. This means that everyone who pays for an electricity bill, is paying for the FITs in some way and those without PV or similar FIT registered technology are paying for those who do have the technologies.

Since April 2010, the FIT has been constantly under review and changes have been introduced to them. The first change was made in April 2011 when, as the Government had promised, the FIT's went up with inflation. The second change came in August 2011. Due to a large number of large standalone PV installations the Government became concerned and consequently reduced the tariff on PV installations. The Government reduced the FIT for these large installations from 29.3 to 8.5 p/kWh but maintained the export tariff as 3 p/kWh. This is a reduction of 71 per cent.

There were many reasons for the Government to do this but this can be divided into two areas. First, the Government was concerned that farmers were starting to hand over their land for large PV installations as the profit of renting the land for PV installations was greater than growing crops or raising cattle. This was of significant concern as less food would be grown and entered into the market (Department of Energy and Climate Change (DECC), 2011c). The second issue the Government faced due to these large scale PV installations was that due to them not foreseeing the



Source: DECC (2011a)

Figure 1.
Graph showing the cumulative increase of PV installations since April 2010

uptake, more money would have to be allocated from the FIT to pay for them. Due to this there was a fear that energy companies would raise the cost of bills to provide more money and allocate this for the short fall in the FIT (DECC, 2011c). By reducing the FIT the Government wanted to make it of a less of an incentive for farmers to give away their land to PV installations. The Government also argued that there would still be enough incentive for larger systems to be installed for example on factory roofs and commercial buildings. The FIT for the larger PV power plants up to 5 MW would still exist but this incentive would be reduced to be minimal and this would prevent the FIT being soaked up.

The second main change was announced in the Governments Comprehensive Spending Review on 31 October 2011. These changes were brought in suddenly and came into effect immediately although planned work could claim the tariff up till 31 December 2011 (DECC, 2011a) as shown in Table II. The changes dramatically dropped the level of FIT on all installations that have not been dropped thus far. For example, on a retrofit < 4 kW, the case for the most common PV installation, and the tariff will drop from 43.3 to 21.0 p/kWh. These drops were expected to happen in April 2012 and were believed, due to the public consultation and popularity, not to be as dramatic as this, thus the review caught a lot of people off guard.

2.3 Types of PV installations

Since the release of the FIT system in the UK, the industry has seen massive growth and companies started to make use of the tariffs and the income that came from them. The original way that was intended was for the public and businesses to purchase the technology and retrofit the PV panel systems to their homes and buildings on roofs and for them to make their money back through the tariff over the 25 years of the tariff. However, due to the generous FIT incentives that the Government provided, businesses have seen a way to make a large profit from PV.

Type	Size of system	1 April 2010-31 March 2011	1 April 2011-31 July 2011	1 August 2011-11 December 2011	12 December 2011-April 2012
Solar PV	$\leqslant 4$ kW new build	36.1	37.8	37.8	21.0
Solar PV	$\leqslant 4$ kW retrofit	41.3	43.3	43.3	21.0
Solar PV	>4-10 kW	36.1	37.8	37.8	16.8
Solar PV	>10-50 kW	31.4	32.9	32.9	15.2
Solar PV	>50-100 kW	31.4	32.9	19.0	12.9
Solar PV	>100-150 kW	29.3	30.7	19.0	12.9
Solar PV	>150-250 kW	29.3	30.7	15.0	12.9
Solar PV	>250 kW-5 MW	29.3	30.7	8.5	8.5
Solar PV	$\leqslant 5$ MW standalone	29.3	30.7	8.5	8.5

Source: www.fitariffs.co.uk

Table II. Table showing the changes over time to the feed in tariff

The first of these profit-making schemes as mentioned above was the farmers building mini PV power stations, up to 5 MW, on their land and claiming the money for the energy produced.

The second more common profit scheme that emerged from the creation of the FIT system was the "Rent a Roof" scheme. This was where a business would go to a household and offer "Free PV" for that building on the basis of renting their roof for an agreed length of time. This would be where the business would buy the PV system for the building but then would claim back the FIT and export tariff to recover the costs over the 25 years and make a large profit due to the generous tariff level. The house holder would receive the electric produced by the system over the 25 years and thus the savings that go along with it. This type of set up has been popular with lower income families who cannot afford the cost of a whole PV installation but want the benefits of savings on their electricity bills. This scheme is also popular with Housing Associations who are using this scheme to help put PV on their housing stocks and reduce fuel poverty among their tenants.

3. Predictive modelling tool

3.1 User interface

To analyse the potential income and savings of the Governments FIT system, a predictive modelling tool was built for this study. This tool is based on the European Commission's for solar radiation (EC, 2011) survey to predict the amount of kWh that would be produced by PV installations and from this it goes on to calculate the potential income and savings of having a PV installation using a set of variables. The predictive modelling tool user interface is shown in Table III.

The user units are inserted in the relevant information space into the calculator as shown in the yellow boxes. The first box of the modelling tool sets the variables for the calculator such as the cost of the energy unit for the building, the FIT level that the installation will receive based upon its size and then the inflation and system degradation. The inflation and system degrading look into the potential for fuel prices to continue to rise higher than normal inflation and allows for the degradation of the system to match that of what is set out in most guarantees in the PV industry.

From here, the user adds in the units of electricity for each quarter of the year that is calculated from existing energy bills and there is a section for night units to be calculated also if they are on a split tariff. The final section for the user to input into the predictive modelling tool is the information from the European Commission. There is a link to their web site from which the user inputs the relevant data such as the area, orientation and size of the system and this then calculates the amount of solar radiation that is statistically average for the location of the users system. The user then takes the information provided and inputs this into the modelling tool.

The tool was developed for a Housing Association in Lincolnshire so that the benefits of PV and the FIT could be clearly explained to both the company and the tenants. The tool was then developed further for this study but still maintains its user-friendly interface so that calculating the potential benefits can be done quickly and easily.

The predictive modelling tool then calculates the results and these are shown in the bottom box of the interface. This box shows the average production of electricity against the user's requirements that were inputted in the units of electricity box. It then shows the potential savings and income from having a PV installation over a one-year period, over a 25-year period and over a 25-year period with inflation and degrading that were set in the variable stage at the top.

Project name	Glen view, four-stones		
Cost of day unit (p/kWh)	11.96		
Cost of night unit (p/kWh)			
Cost of system (£)	13,055		
Size of PV system (kW)	4		
Feed in tariff (p)	43.3		
Export tariff (p)	3.1		
Inflation (%)	3		
Fuel inflation (%)	6		
System degrading (%)	0.5		
Date	Day unit (kWh)	Night unit (kWh)	
1st Quarter (January-March)	1,013		
2nd Quarter (April-June)	968		
3rd Quarter (July-September)	930		
4th Quarter (October-December)	1,122		
Go to web site and get results			
http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php			
Month	Electricity production		
January	113		
February	174		
March	279		
April	360		
May	441		
June	408		
July	424		
August	372		
September	303		
October	205		
November	129		
December	75		
Results			
Average production per year (%)	83.69		
	Over 1 year	Over 25 years	Over 25 years with degrading and inflation
Electricity production (kWh)	3,283.00	82,075.00	77,150.50
Current cost of electricity (£)	482.35	12,058.67	26,463.72
Potential savings (£)	392.65	9,816.17	19,934.47
Income from feed in tariff (£)	1,421.54	35,538.48	48,323.84
Income from export tariff (£)	50.89	1,272.16	1,729.84
Total income and savings (£)	1,865.07	46,626.81	69,988.15

Table III.
User interface of the predictive modelling tool

3.2 Monitoring of the PV FIT over a year

To evaluate the accuracy of the tool developed, the study monitored an installation in Northumberland in the UK for a period of one year. The monitored house is shown in Plate 1. The system was installed on 7 January 2011 by Barrier Energy (www.barrierenergy.co.uk/) and was monitored monthly by the authors of this report to see what difference was between the prediction provided by the calculator and the actual results. The system size was just below a 4 kW size so that it could sit in the highest FIT bracket and achieve maximum

Plate 1.
Photo of PV installation being monitored

potential. The system also faced south over the Tyne Valley without any shading of any kind and was retrofitted to a roof of a building with a 35° pitch. The whole system cost £13,055 for installation. The results of the monitoring are shown in Table IV.

Table IV shows clearly that the system over performed for ten of the 12 months of the year and over the entire year the system gave an average of 41.3 kWh extra each month. This evidence backed up with the evidence from Figure 2 that shows that there is a very clear relationship between the estimated calculations from the predictive modelling tool and the actual results from monitoring the system.

Using these results the study was able to verify that the PV predictive modelling tool was in fact accurate even though the weather can change from month to month and year to year. The monitoring of the system will continue to build up more data on these results.

Table IV.
Table showing the estimated electricity production against the actual production

Month	Electricity prediction	Actual production	Difference	Feed in tariff
January	113	136	23	£58.21
February	174	129	−45	£55.21
March	279	337.4	58.4	£144.41
April	360	511.8	151.8	£229.54
May	441	532.3	91.3	£238.74
June	408	475.1	67.1	£213.08
July	424	477.8	53.8	£214.29
August	372	355.8	−16.2	£159.58
September	303	368.1	65.1	£165.09
October	205	230	25	£103.16
November	129	143.7	14.7	£64.45
December	75	81.9	6.9	£36.73
		3,778.9	495.9	£1,682.49

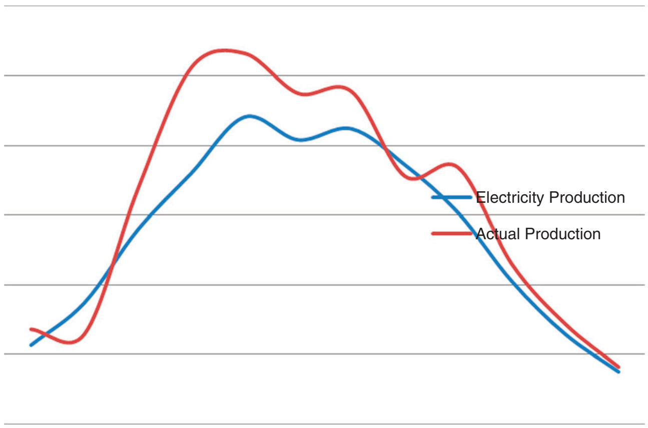


Figure 2.
Graph showing the estimated electricity production against the actual production over one year

4. Impact of the governments spending review 2011

4.1 Calculations into the impact

On 31 October 2011 the UK Government published in Spending Review of the FIT system. By reducing the tariffs by up to half, the impact on the industry was massive and sent shockwaves throughout, especially due to the fact that the changes were immediate. Using the predictive modelling created for this study we can see what effects the Spending Review will have upon the potential savings and income for the FIT and see how this will affect the industry.

By using the example of the house in Northumberland and comparing the difference between the tariffs, we can see a vast reduction in the income for the PV panels. From Tables V and VI we can see that although the amount of electricity remains the same as there is no change in the panels, the income that comes from the FIT has dropped dramatically from £1,421.54 to £689.43 a year. The savings and the export tariff remain the same but the reduction of over £700 a year could have a dramatic effect on the pay back periods of these systems.

We can also see from the graph the massive reduction in the amount of income over a 25-year period. Without the inflation variables and degrading of the system, the predictive modelling tool calculates that over 25 years the PV panels will bring in near £47,000 with the old tariff of 43.3 p/kWh while with the reduction to 21 p/kWh we can see this drop to just over £28,000. This drop of nearly £20,000 could have a massive effect on the industry as the incentive is not as much. This is also shown

Results			
Average production per year (%)	83.69		
	Over 1 year	Over 25 years	Over 25 years with degrading and inflation
Electricity production (kWh)	3,283.00	82,075.00	77,150.50
Current cost of electricity (£)	482.35	12,058.67	26,463.72
Potential savings (£)	392.65	9,816.17	19,934.47
Income from feed in tariff (£)	1,421.54	35,538.48	48,323.84
Income from export tariff (£)	50.89	1,272.16	1,729.84
Total income and savings (£)	1,865.07	46,626.81	69,988.15

Table V.
Table showing the results of the predictive modelling tool with feed in tariff set at 43.3 p/kWh

with the variables as the drop from nearly £70,000 to £45,000 shows a drop of £25,000. The tool changes based on the data inputted but the tool allows seeing the benefits to the home owner for the next 25 years based on estimations of interest rates and degradation.

This is clearly depicted in Figure 3 showing how the accumulative income rises and how the cost of the system will be paid back. According to the graph, on the old tariff rate of 43.3 p/kWh the payback period would be around six to seven years if the variables were correct over that time. However, with the reduction in FIT to 21 p/kWh the payback period for the system will now take ten to 11 years to pay off.

From this graph we can still see that the cost of a PV system under these new levels is affordable and that their users will still make a large profit over the period of 25 years. The initial investment of £13,055 comes out as near as £45,000 so there is still plenty of incentive for the installation of PV.

The calculations above took into account both the potential income and savings for having PV installed on a user's house as in the case of the building in Northumberland. As stated earlier, the further south the installation is, the more sunlight will be absorbed into the panels. If this installation was further south the impact of the Governments spending review would have the same effect on the reduction per kWh. The calculations above show that the reduction country wide on the income from the FIT will be 51 per cent on the installations below 4 kW. However, if we were to take the case of a "Rent a Roof" system where the installer would only receive the FIT rather than making any savings the payback period for these installations could be a lot different.

Table VI.
Table showing the results of the predictive modelling tool with feed in tariff set at 21 p/kWh

Results			
Average production per year (%)	83.69		
	Over 1 year	Over 25 years	Over 25 years with degrading and inflation
Electricity production (kWh)	3,283.00	82,075.00	77,150.50
Current cost of electricity (£)	482.35	12,058.67	26,463.72
Potential savings (£)	392.65	9,816.17	19,934.47
Income from feed in tariff (£)	689.43	17,235.75	23,436.50
Income from export tariff (£)	50.89	1,272.16	1,729.84
Total income and savings (£)	1,132.96	28,324.08	45,100.82

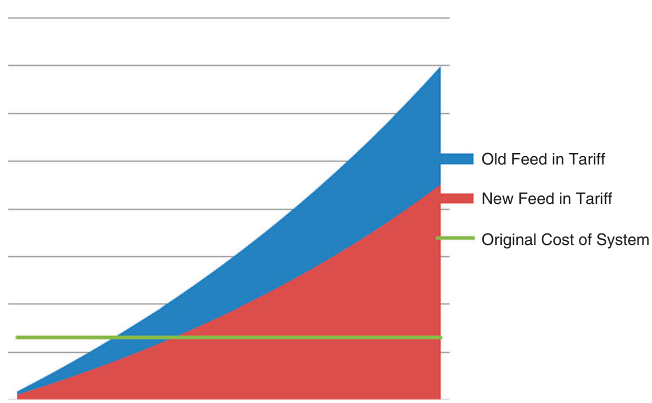


Figure 3.
Comparison of the 43.3 p/kWh tariff against the 21 p/kWh and the payback periods

This is shown in the graph of Figure 4. Here it is clear that the comparison of the income over 25 years accumulating solely from the FIT. On the old 43.3 p/kWh rate the income comes in at nearly £1,500 a year and this creates a payback period of around eight to nine years for the £13,055 system. This would be great for the "Rent a Roof" business as over the 25-year lifespan of the FIT they would generate over £48,000 in income which would result in a potential £35,000 profit. However, on the new tariff rate of the 21 p/kWh we can see that only using the income from the FIT the payback period increases to 15-16 years and over the lifespan of the FIT and the potential profit over the 25 years is only £10,000. This may still be a substantial financial gain but it does increase the risk further for the "Rent a Roof" businesses as this would be the best case scenario. If the inverter were to break down and need replacing twice within the 25 years then this cost could offset the profit gained.

4.2 Negative and positive impacts
From the research out for this paper and the calculations presented, we can see that the impact of the reduction of the FIT could be regarded as detrimental to the industry, but the reduction is not enough for people to completely write off the incentives for installing PV panels on their properties. The negative impacts of the reduction of the FIT, other than less income, will be that the "Rent a Roof" systems will be far less common as the risk for businesses investing money will be much higher. This will result in the lower income households not being able to afford the systems once again as the capital costs would be too high. This would also be the case for housing associations and councils who may no longer be able to install PV onto their buildings due to the risk involved especially for larger scale buildings where the tariff would be lower.

The reduction in the FIT is still set at an appealing level for those who want to invest in PV panels over the 25-year lifespan of the FIT. Concomitantly, there is still a profit to be made as well as the savings that will be received by generating the electricity from the system. Another positive aspect of the reduction of the FIT is that the reduction will lead to less money being required for the FIT. This in turn will not be transferred onto energy bills by the companies, whereas, with the massive intake of PV being taken up, if there was not a reduction then this would have eventually been transferred onto the energy bills. This would have a greater impact on those without PV as they would not be generating their own electricity.

Although the reduction in FIT will have an effect on the payback period, this will also be evened out by the reduction in the cost of the PV systems (Department of Energy and

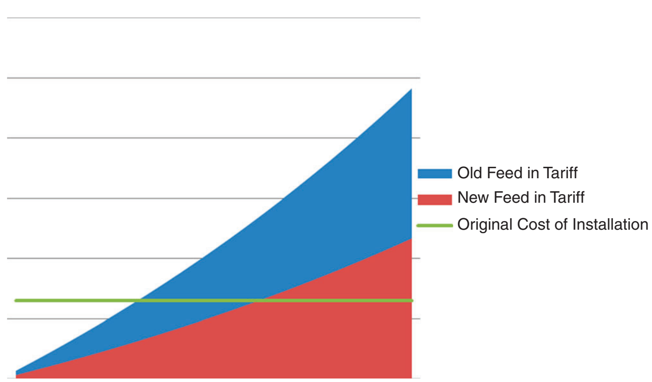


Figure 4.
Comparison of the 43.3 p/kWh tariff against the 21 p/kWh and the payback periods with only the Feed in Tariff as income

Climate Change, 2010). The system monitored for this report was purchased for £13,055 in January 2011. Since then, the price of a PV system in the UK has dropped dramatically due to the large uptake to the scheme. A 4 kW PV system can now be bought for around £7,000, which is nearly a reduction of 50 per cent over the time. This works in parallel with the reduction in the FIT as they were also nearly 50 per cent reduced. This reduction in cost could result in "Rent a Roof" systems not going out of business due to the risk as the cost of installation has gone down and so the payback period will also reduce. However, the profits will still not be as high as before.

5. Conclusion

This study has identified many potential impacts from the UK Governments Spending Review in 2011 on PV panels. Although initially the industry was heavily surprised with the Governments response to the spending review, this study shows that the UK Government actions through the spending review may have been the right course overall. The FIT and the incentive that it provides are still at a level to justify the installation of a PV system and the associated profits over the 25-year period. However, it has to be argued that not many building owners will be able to plan financially for a 25-year period. Also, with the large intake from the previous FIT levels the price of the PV installations has reduced dramatically to nearly less than half of the cost back in April 2010.

A problematic situation from the reduction in the FIT is its effect on what the "Rent a Roof" companies. These companies may no longer invest in the PV systems offering people free electricity as the income will be lower and the risk will be greater for them. However, due to the fact that the reduction in the initial installation cost has dropped dramatically then this should not be too much of a problem.

(It seems the arguments are not conclusive and in some cases may contradict each other's).

One of the conclusions made by this research is that the reduction in the FIT was the right move by the Government as it should prevent the increase in energy bill prices which will affect the people without PV at this point in time. It also has been set so that it is still generous enough to encourage the industry and stimulate installation as there is still profit but not in a way that should put people off. The UK may just have to take time to realise that the FITs are still a good deal after the very generous tariff that preceded them. This research concludes that the FIT had not dropped to a level that was undesirable but the opposite and that the FIT was still a good incentive for people investing in PV. However, the reduction in the FIT may impact the "Rent a Roof" system and this in turn will impact most heavily on lower income families. The research also concluded that the changes in the political agenda have had a major impact on the "Feed in Tariff" for both the industry and the community. Thus, the solar FITs will continue to be an attractive incentive in place to pay for heating through renewable means and thus ensuring reducing our own carbon footprint. To conclude, well-developed ownership schemes need to be put in place.

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About the authors

Dr Amira Elnokaly holds a BSc (First Class Hons.) in Architecture, Cairo University, Mphil/PhD (University of Nottingham) in Sustainable Design and Architecture. Elnokaly is also a registered Architect in Egypt since 1998. Elnokaly is currently a Senior Lecturer at the Lincoln School of Architecture, the University of Lincoln. Prior Joining the University of Lincoln Elnokaly was an Assistant Professor of Architecture at the Architectural Engineering and Environmental Design Department, at the AASTMT, Egypt (www.aast.edu). In 2008 Elnokaly received an Honoree Award from the Environmental Education and Outreach Program (E3OP) – UNESCO program (Educational Ministry & Environmental Ministry) for effective role undertaken in spreading environmental awareness and global warming effects in Alexandria, Egypt. Elnokaly's research interests are diverse but are related by a consistent concern with embracing a sustainable mindset in architectural education, and ecological and environmental related issues in the Built Environment. Elnokaly has published on Sustainable Architecture and Environmental Design of Buildings, the application of CFD in Building Design, Renewable Energy Technology, Curriculum Development, Architecture Design Studio Teaching and Sustainable Urban Regeneration. Elnokaly has been a Lecturer and a design studio tutor since 1998 and taught at the University of Nottingham, the AASTMT Alexandria, the AASTMT Cairo and the University of Lincoln. Elnokaly has secured a number of research funds in the last years. Elnokaly also serves as a reviewer for several International Journals and on the Scientific Committee of a number of International Journals, Conferences and Symposiums. Dr Amira Elnokaly is the corresponding author and can be contacted at: aelnokaly@lincoln.ac.uk

Benjamin A.J. Martin, originally from Northumberland Benjamin studied Architecture at the University of Lincoln. Following this he worked as a Retrofit Project Officer for a large housing association in Lincolnshire where he gained a passion for sustainable architecture and renewable energy. He then went back to Lincoln to study his passion in the MSc in Sustainable Architectural Design which he completed with a distinction in 2012. He now works for the University of Nottingham in a KTP project looking into ETFE structures after travelling and living in South East Asia. He currently lives in Nottingham with his wife and cat and enjoys gardening, history and cooking.