Title: Government Response to Consultation on Feed-in Tariffs Comprehensive Review Phase 2A: Solar PV Tariffs and Cost Control IA No: DECC0091 Lead department or agency: DECC Other departments or agencies:	**Impact Assessment (IA)** **Date: 24 May 2012** **Stage:** Final **Source of intervention:** Domestic **Type of measure:** Secondary legislation **Contact for enquiries: Andrew Jones**
Summary: Intervention and Options	RPC: **N/A**

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year**	**In scope of One-In, One-Out?**	**Measure qualifies as**
£4,500m	£m	£m	No	N/A

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

Feed-in Tariffs for small scale generation technologies were introduced in April 2010. Recent evidence shows that uptake of solar PV has been much faster than originally anticipated, triggered by a substantial fall in PV costs. Evidence also shows that solar costs are continuing to fall. Intervention is necessary to ensure that tariffs reflect latest evidence on costs, do not provide excessive profits to investors and can quickly respond to changes in deployment.

What are the policy objectives and the intended effects?

The policy objectives are to encourage the take up of small scale generation as part of the portfolio approach to meeting the 2020 renewables target. The intended effects are to enable householders and smaller scale investors to engage directly in the transition to a low carbon economy and to develop the supply chain. These need to be done in a way that is cost-effective and can be achieved within current spending limits.

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

2 options have been considered:

(i) Option 1: Do Nothing – leaves current policy (ie as set out in lead option from Phase 1 Government response IA (http://www.decc.gov.uk/assets/decc/Consultations/fits-review/4310-feedintariff-comprehensive-review-phase-1-impact.pdf) unchanged (April tariffs adjusted for inflation)

(ii) Option 2: Reduce tariffs on 1 August 2012; then implement contingent degression mechanism from November 2012 onwards; in addition, apply further modifications to tariffs, including shortening tariff lifetime and increasing the export tariff.

Option 2 is the preferred option as the proposed August tariffs better reflect latest evidence on solar PV costs and the proposed contingent degression mechanism allows for a smoother growth path for the technology whilst remaining within spending limits.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** ongoing					
Does implementation go beyond minimum EU requirements?			**Yes / No / N/A**		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro Yes**	**< 20 Yes**	**Small Yes**	**Medium Yes**	**Large Yes**
What is the CO2 equivalent change in greenhouse gas emissions? (Million tonnes CO2 equivalent)			**Traded: +146**	**Non-traded:**	

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

Date: 24/05/12

Summary: Analysis & Evidence

Policy Option 1

Description: Chosen Option- lower tariffs for new solar PV installations from 1 August 2012, with contingent degression based on deployment every 3 months from 1 November

FULL ECONOMIC ASSESSMENT

Price Base Year 2010	PV Base Year 2010	Time Period Years 43	Net Benefit (Present Value (PV)) (£m)		
			Low: -3,700	High: 11,500	Best Estimate: 4,500

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant	Total Cost (Present Value)
Low				4,700
High				3,100
Best Estimate				4,300

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

The monetised cost is the value of EUA purchases in the UK power sector. In this instance there is lower PV deployment than under the no change scenario, and therefore a lower value of carbon benefits. The high estimate is based on our fast cost reduction scenario, the central on our medium cost reduction scenario and the low on our slow cost reduction scenario

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

Higher energy losses in transmission/distribution, as lower PV uptake leads to less on-site electricity usage, are not included. Foregone behavioural impacts due to lower PV uptake at a domestic level are also not accounted for.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant	Total Benefit (Present Value)
Low				1,000
High				14,600
Best Estimate				8,900

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

The benefits of this option relate to the lower resource costs associated with PV as a result of lower deployment under reduced tariffs compared with the option of continuing with existing tariff policy.

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

By reducing subsidy (as well as resource) costs of PV under the FITs scheme, this policy will ensure the cost of the scheme remains within the current spending limits ensuring that FITs can continue supporting a portfolio of small scale low-carbon generation technologies going forward. Lower PV deployment will also avoid incurring some variable scheme administration costs, and will entail lower system balancing costs if conventional forms of generation (ie CCGT) are built instead. Less deployment under FITs will result in lower subsidy costs and will reduce the impact of FITs on consumer bills.

Key assumptions/sensitivities/risks **Discount rate** 3.5

Mean hurdle rates 8% (domestic) 8.5% (commercial) 9% (developer/utility). Learning rate of 14% for each doubling of capacity. Maximum market growth rates higher than previously assumed. Energy efficiency requirement reduces solar PV technical potential by 40% (2012-13) 25% (2013-14) and 10% for future years. DECC electricity/carbon price projections used. Significant uncertainty as to costs and uptake of PV going forward, demonstrated through sensitivities around short-term uptake to end July, learning and hurdle rates. If hurdle rates are overall +/-2% of our central assumptions, range of uptake could be 4GW – 21GW (including sensitivities on cost reduction scenarios) . Contingent degression mechanism should limit risks to overall FITs affordability.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			In scope of	Measure qualifies
Costs:	Benefits:	Net:	No	In/Out/Zero Net

A: Strategic Overview

1. Feed-in tariffs (FITs) were introduced in Great Britain on 1 April 2010 to incentivise small scale (up to 5MW), low carbon electricity generation. This small scale FITs scheme works alongside the Renewables Obligation (RO), which is the primary mechanism to incentivise deployment of large-scale renewable electricity generation. These, together with the Renewable Heat Incentive (RHI), Renewable Heat Premium Payment and the Renewable Transport Fuel Obligation are needed to incentivise uptake of renewable energy technologies to meet the UK share of the EU renewable target of 15% renewable energy by 2020.

2. The strategic aim of the FITs programme is to deliver an efficient, accessible and affordable scheme which drives cost effective deployment of decentralised low-carbon electricity generation technologies. This should include ensuring the provision of value for money to consumers by introducing and managing cost control mechanisms that keep spend within defined parameters consistent with the Levies Control Framework.

3. The strategic aim is underpinned by the following strategic objectives:

    - To maintain accessibility of the FITs scheme to diverse participants through efficient and effective administration, and by providing them with consistency and stability
    - To increase energy efficiency and reduce energy demand by promoting behaviour changes by individuals and communities
    - To reduce installation costs by improving learning rates and, in doing so, to position the UK to secure maximum cost effective renewables deployment, security of supply and grid benefits if and when solar PV becomes competitive with other renewable technologies; and
    - To support the transition to the Green Deal by ensuring maximum upskilling and availability of home energy experts.

4. On 7 February 2011, the Secretary of State announced the start of the first comprehensive review of the FITs scheme. In doing so, he confirmed that the review would assess all aspects of the scheme including tariff levels, administration and eligibility of technologies, and would be completed by the end of the year, with tariffs remaining unchanged until April 2012, unless the review reveals a need for greater urgency.

5. As part of the comprehensive review, the Government gave fast-track consideration to large-scale (over 50kW) and standalone solar PV tariffs (as well as farm-scale anaerobic digestion) in response to evidence of a significant fall in PV costs and unanticipated uptake at this scale.

6. On 31 October 2011 as part of Phase 1 of the review a further consideration of solar PV tariffs was announced in response to evidence of a significant fall in solar PV costs at all scales and higher than anticipated uptake. The Government Response to the Phase 1 consultation, published in February 2012, established that tariffs would be reduced from 1 April 2012 for installations with an eligibility date on or after 3 March 2012 (see Table 1 below). In addition, an energy efficiency requirement was put in place for installations attached or wired to provide electricity to a building. Installations that are not attached or wired to provide electricity to a building with an Energy Performance Certificate (EPC) at band D or above would not be eligible for the standard generation tariff, but would instead receive a lower tariff of 9p/kWh. Finally, a new tariff was put in place for multiple ('aggregated') installations (see Table 1), applying to any solar PV installation where the FIT generator or nominated recipient already owns or receives FITs payments from 25 or more other PV installations, located on different sites. The multi-installation tariff was set at 80% of

the tariff for single installations. Table 1 shows current tariff levels for solar PV under the FITs scheme. Since the Phase 1 Government Response published on 9 February 2012[1] proposed no tariff future degression, these tariffs (adjusted over time for RPI inflation) would continue to apply in future if no further changes were made to the scheme. The tariffs therefore represent the 'Do Nothing' scenario in this Impact Assessment.

Table 1: Government Response to Phase 1 consultation (i.e. current) solar PV tariffs

Tariff band (kW)	**Previous generation tariff (p/kWh)**	**Current generation tariff (p/kWh)**	**Current multi-installation generation tariff (p/kWh)**
4kW or less (new build)	37.8	21.0	16.8
4kW or less(retrofit)	43.3	21.0	16.8
>4-10kW	37.8	16.8	13.4
>10-50kW	32.9	15.2	12.2
>50-100kW	19	12.9	10.3
>100-150kW	19	12.9	10.3
>150-250kW	15	12.9	10.3
>250kW-5MW	8.9 [2]	8.9[2]	N/A
stand alone	8.9 [2]	8.9[2]	N/A

7. Alongside the announcement of the Government Response to the Phase 1 comprehensive review consultation, DECC also launched a consultation on Phase 2A of the review which set out proposals for solar PV tariffs for July 2012 together with proposals for future tariff degression and potential changes to the export tariff, tariff lifetime, and tariff indexation. These proposals took into account an update of solar PV cost assumptions by Parsons Brinckerhoff (PB) conducted in January 2012 and published alongside the consultation ('the February report')[3], which found that costs had fallen faster than had been anticipated in October 2011. Three options for July 2012 tariffs were set out which depended on observed deployment in March and April 2012[4]:

    - **Option A:** preferred option if March/April deployment exceeded 200MW; tariff for sub-4KW installations of 13.6p/kWh;

    - **Option B:** preferred option if March/April deployment ranged from 150-200MW; tariff for sub-4kW installations of 15.7p/kWh;

[1] http://www.decc.gov.uk/assets/decc/Consultations/fits-review/4312-feed-in-tariff-review-phase-i-gov-response-.pdf
[2] No multi-installation tariff set for 250-5000kW and Stand alone bands. Phase 1 Government response left these tariffs unchanged at 8.5p/kWh; tariffs in these bands were subsequently uplifted for RPI inflation on 1 April to 8.9p/kWh.
[3] See http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/renewable-energy/4290-solar-pv-cost-update-report--3-feb-2012-.pdf
[4] March and April deployment here refers to deployment after 3 March (eligibility date for new tariffs in Phase 1 Government Response IA)

- **Option C:** preferred option if March/April deployment below 150MW; tariff for sub-4kW installations of 16.5p/kWh.

8. Under all 3 options it was proposed that tariffs would be degressed by 5% in October 2012 and by 10% every 6 months thereafter[5].

9. Following the announcement of the response to the Phase 1 consultation, there was a further surge in deployment up to 3 March (the eligibility date for new tariffs) for installations at 43p/kWh. Deployment since the 3 March eligibility date set out in the Government response to the Phase 1 consultation has been around 90MW.

10. Alongside the Phase 2A consultation, DECC commissioned PB to carry out a further update to solar PV cost assumptions [6]. The research for this report was carried out at end March/beginning April, and incorporated responses to the Phase 2A consultation as well as industry views and data. The updated evidence shows that estimates of April installation costs of small-scale (sub-50kW) PV systems are 10-20% lower than the estimates for January installations in the February report, while the estimates of April installation costs of larger scale systems are 10-30% higher. Estimates for future costs reductions have also been revised down with a central estimate of 10% cost reductions per annum for the next two years (compared with around 20-25% to the end of 2012 and around 15% for 2013 in the February report).

11. Taking account of this latest cost and deployment information, the Government Response to the Phase 2A consultation sets out final decisions on solar PV tariffs from August 2012, a way forward for tariff degression, as well as amendments to tariff lifetime and export tariff. This Impact Assessment provides a cost benefit analysis of these decisions.

B: Problem under consideration

12. As set out in the Phase 2A consultation Impact Assessment, it is clear that costs of PV have fallen much more rapidly than was predicted at the start of the scheme. This has led to much stronger take-up than was envisaged, risking the affordability of the entire FITs scheme. The consultation proposed new tariffs and a cost control mechanism for solar PV given the need to continue to deliver the objectives of the FITS scheme while maintaining overall FITs affordability and value for money. Phase 1 of the comprehensive review considered these issues in setting appropriate tariff levels for April 2012. This impact assessment considers these issues with respect to setting appropriate tariff levels for August 2012 onwards.

C: Rationale for intervention

13. From its establishment in April 2010, the FITs scheme was intended to encourage deployment of additional small scale low carbon electricity generation, particularly by individuals, householders, organisations, businesses and communities who have not traditionally engaged in the electricity market. For these investors, delivering a mechanism which is easier to understand and more predictable than the Renewables Obligation, as well as delivering additional support required to incentivise smaller scale and more expensive technologies, were the main drivers behind the development of this policy.

[5] For more details see Phase 2A draft Impact Assessment (http://www.decc.gov.uk/assets/decc/Consultations/fits-review/4320-feedin-tariffs-review-phase-2a-draft-impact-asses.pdf).

[6] Parsons Brinkerhoff, 'Solar PV Costs Update- May 2012'. Available at http://www.decc.gov.uk/en/content/cms/consultations/fits_rev_ph2a/fits_rev_ph2a.aspx

14. FITs was intended to support the deployment of proven technologies now and up to 2020, rather than to support development of unproven technologies. PV was seen as a well developed technology that could be deployed at scale in domestic, community and small business settings and drive consumer and small business engagement in renewable technologies. While relatively high cost, it has broad public acceptance and can be easily incorporated into the built environment. Because carbon prices are not high enough to incentivise solar PV in the short and medium term, government intervention is necessary to incentivise the private sector to invest in this technology in order to contribute towards meeting 2020 Renewables target.

15. In the light of new evidence on costs and uptake, this IA assesses appropriate tariff levels from August 2012 needed to meet the objectives of the scheme, whilst meeting budgetary constraints as set out in DECCs levy control envelope. This IA also assesses the impact of other changes to FITs for solar PV, including tariff degression mechanisms, shortening of tariff lifetimes and increasing the export tariff.

D: Evidence Base

Solar PV installation costs

16. Research carried out for DECC by PB / CEPA in September 2011 and published alongside the Phase 1 consultation on 31 October 2011 suggested that PV installation costs had fallen by at least 30% between the launch of the scheme and Autumn 2011. This meant that original scheme tariffs were leading to typical rates of return for investors well in excess of the 5% that the tariffs were intended to deliver. Additional evidence received by DECC during the Phase 1 consultation period, and an update to the September report undertaken by PB and published in February, suggested that PV installation costs had in fact fallen by an even greater extent. This information informed proposals for tariffs for solar PV installations from July 2012 onwards, including a proposed tariff degression mechanism, as set out in the Phase 2A consultation.

17. Following the close of the Phase 2A consultation, DECC commissioned PB to carry out a further update of solar PV costs to support the Government Response to the consultation[7]. PB's central estimates for capex for smaller installations (up to 50kW) in April 2012 are 10–20% lower than their estimates for smaller installations in January set out in their February report. This is a result of a both larger data set being available for this update and actual cost reductions that have taken place at this scale since January. For installations larger than 50kW, costs for April installations are 10-30% higher than for January installations in the earlier update. This reflects more detailed data available for this report, and is in line with industry feedback on the February report.

18. The updated evidence also suggests that the capital costs for multiple installations ("aggregated") projects are about 10% lower than for individual installations, taking into account both the economies of scale experienced by such projects as well as additional costs incurred (such as legal costs for conveyancing, and long running administration costs for initialising and maintaining projects). This compares with the earlier estimate that such costs were 35% lower.

19. The range for April 2012 capex is also narrower than in the February report. 'Low' and 'High' values now calculated mathematically, representing the first and third quartile of the data set in each band respectively, rather than PB's judgement of the range of reasonable costs. The Low and High ranges are much narrower than in the February report: the low estimate

[7] Available at http://www.decc.gov.uk/en/content/cms/consultations/fits_rev_ph2a/fits_rev_ph2a.aspx

is now 75-95% of the high estimate, whereas in the February report it was 35-65% of the high estimate.

20. PB have also moved to forecasting future cost reductions based on (a) an assessment of market views and supply and demand factors (out to end 2013) and (b) a learning rate formula (from the beginning of 2014). In their February report, both near-term and longer term cost reduction estimates were based on PB's judgement of the various factors influencing costs.

21. In the near term, PB forecast cost reductions of 0-20% (central case 10%) in the year until March 2013, with further falls of 5-20% in the year to March 2014 (central case 10%). In the February report, PB forecast reductions of 20-25% to December 2012, and 15% for 2013.

22. To estimate longer term cost reductions, PB have assumed a learning rate of 14%, i.e. costs will reduce by 14% for every doubling of capacity[8]. Worldwide capacity projections have been used to generate cost reduction estimates[9]. For the fixed cost element associated with sub-4kW installations, cost reductions are calculated based on UK capacity: since these costs are connected to installation, learning here will be more related to UK factors than worldwide ones. As with current capex, low/central/high projections of future capacity are used to give slow/central/fast cost reduction scenarios.

23. Taking all the changes together, PB's cost estimates for July 2012 installations are around the same as in the February report for sub-50kW installations, but substantially higher for larger (above 50kW) installations and aggregators[10]. PB's new estimates of capex for July 2012 installations are compared to the figures in the February report in Table 2 below:

Table 2: Current capex (Central values), February and May PB costs updates

	Installed cost per kW, Jul-12 installation		
Size Band	PB Jan Update	PB May update	% change
<4kW	2663	2493	-6%
4-10kW	2128	2207	4%
10-50kW	1952	1956	0%
50-150kW	1423	1834	29%
150-250kW	1123	1659	48%
250-5000kW	1036	1265	22%
Standalone	1036	1265	22%
Aggregators <4kW	1727	2231	29%
Aggregators >4kW	1425	1893	33%

24. The charts below compare PB capex projections for 2.6kW and 350kW installations from the February and May reports. For 2.6kW installations cost projections in the central case from the May report are very similar to those from the February report from 2014 onwards, as lower estimates of current capex are balanced by slower near-term cost reductions. For 350kW installations, cost projections from PB's latest report are above those from their earlier report throughout the period in the central case.

[8] Taken from "PV Learning Curves: Past and Future Drivers of Cost Reduction" Kersten *et al* 2011.
[9] Source: "Solar Generation 6: Solar Photovoltaic Electricity empowering the World", EPIA/Greenpeace 2011; and "Global Market Outlook- 7th Market Workshop", EPIA, March 2012.
[10] Monthly capex estimates obtained by extrapolating between annual values.

Chart 1: Comparison of cost reduction profile between February and May PB updates, 2.6kW installations

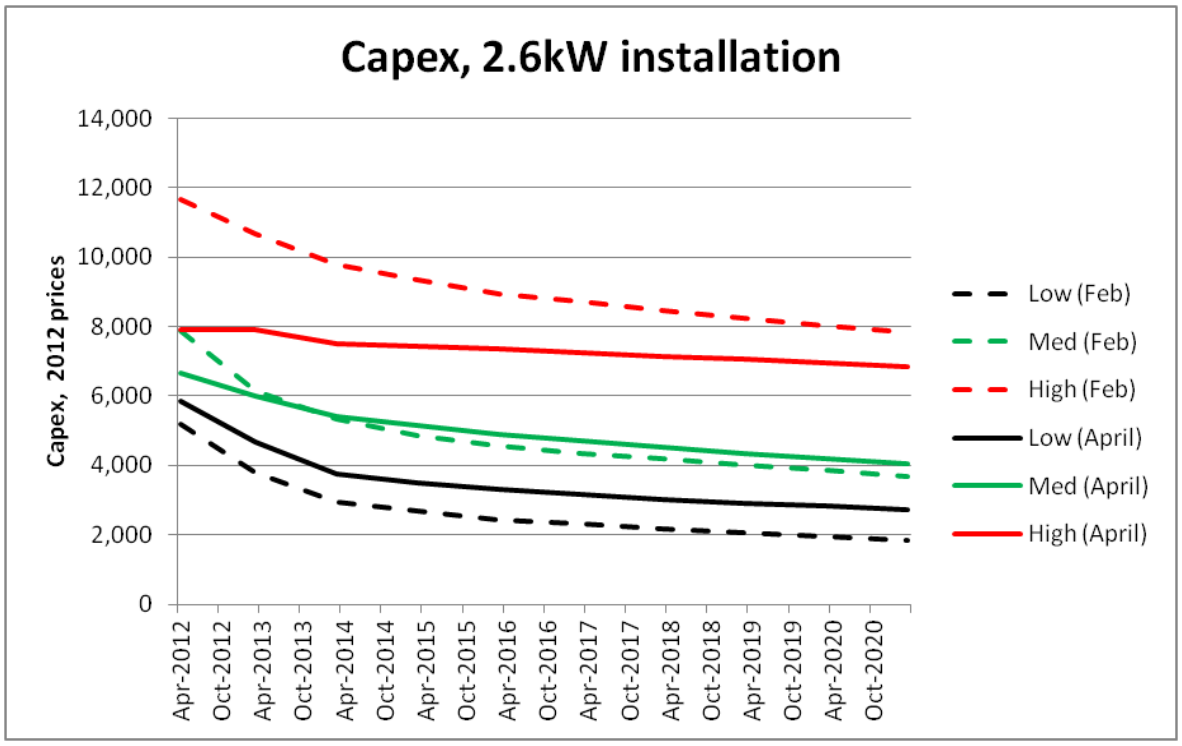
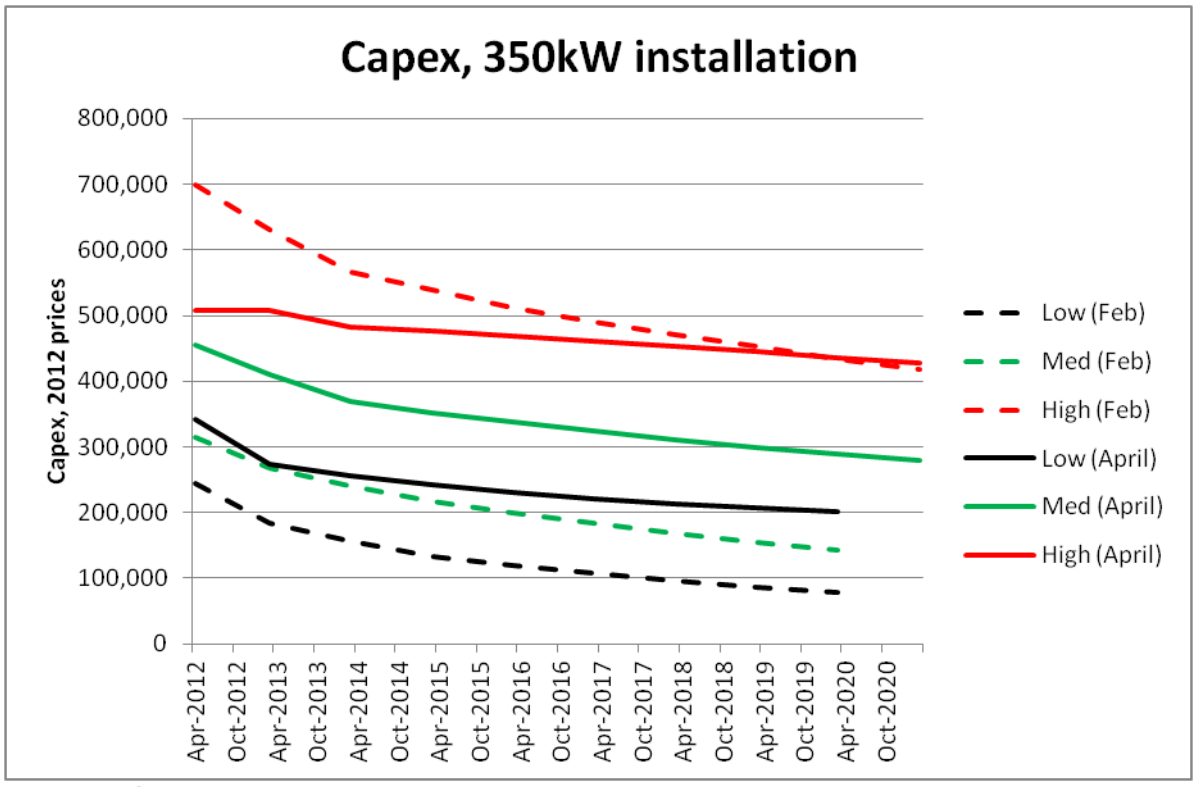


Chart 2: Comparison of cost reduction profile between February and May PB updates, 350kW installations



Notes on charts:

- February scenarios refer directly to the Low/Medium/High scenarios constructed by PB
- May 'Low' scenario combines low end estimate for current capex with fast future cost reduction scenario; Medium scenario takes central current capex/medium future cost reduction; High scenario takes high current capex/slow future cost reduction.
- It is not possible to make a direct comparison between the Low/High scenarios between the February and May reports. For the February report, the Low/High range represented PB's estimate of the 'range of reasonable costs' based on what the market was offering, whereas for the May report the Low/High values are calculated mathematically (first and third quartiles of the data set).

Deployment

25. Since the introduction of FITs, costs of solar PV have fallen far more rapidly than originally projected, and uptake has consequently been far higher. By 3 March (the eligibility date for new tariffs set out in the Government response to the Phase 1 consultation, reducing tariffs for a <4kW installation from 43.3p to 21p) there had been nearly 1,100MW of PV deployment, nearly 8 times more than originally estimated for the first two years of the FITs scheme. Since 3 March there has been a further 84MW of deployment, taking the total to nearly 1,200MW and exceeding the projections for total deployment by 2014 made at the time the scheme was launched. Tables 3-4 below set out deployment to date based on latest available data.

Tables 3-4: Solar PV deployment, pre and post 3 March eligibility date

Table 3

Solar PV deployment to end February (week ending March 4) 2012		
Size	Deployment (MW)	Number of installations
<4kW	720*	280,000**
4 - 10kW	50*	8,000**
10 - 50kW	120*	6,000**
50kW +	210	1,000
Total	1,090	290,000

Table 4

Solar PV deployment March 5th - April 2012		
Size	Deployment (MW)	Number of installations
<4kW	70*	25,000*
4 - 10kW	3*	200*
10 - 50kW	12*	400*
50kW +	0	0
Total	84	26,000

Note: Totals may not sum due to rounding.

*Based on CFR and MCS with MCS adjustment[11]

**Estimated number of installations based on assumed installation size

Modelling Approach

26. Since the publication of the Phase 2A consultation, DECC has re-calibrated the FITs model using observed uptake data and updated modelling assumptions to improve the robustness of forecasts for solar PV uptake and costs.

27. Key updates to the FITs model for solar PV include:

Re-calibration of supply constraints. Supply constraints limit the maximum forecast uptake in the model. Under old supply constraint assumptions, the model could not replicate observed levels of deployment even at very high tariff levels. These constraints have been loosened to allow for a greater amount of potential deployment each year. These are based on estimated maximum build rates. For small scale deployment, this is based on the maximum installation rate achieved over a 6 week period, assuming this installation rate

[11] Solar PV installations receiving FITs payments are registered OFGEMs Central FITs Register (CFR). In addition, data for <50kW installation only are available directly from the Microgeneration Certification Scheme (MCS) database. An installation will appear on the MCS before it appears on the CFR, and so MCS data are used to get the best estimate of deployment to date for <50kW installations. The total PV capacity registered on the MCS database was 1080 MW on 6th May. However, evidence suggests that 10% of installations registered on the MCS database are never transferred to the CFR, and therefore do not become eligible for FITs. When estimating the costs of the scheme, we therefore reduce the capacity of installations registered on the MCS by 10%.

continues for a full year. For larger scale installations, this is estimated by assuming that 25% of the maximum potential deployment in 2011/12 was incentivised.

In addition, separate supply constraints now apply to different segments of the Solar PV market by size band, to better reflect the potential build speed in these segments.

Revised demand assumptions. It is very difficult to observe investor hurdle rates for Solar PV. What's more, hurdle rates are likely to shift over time as attitudes towards Solar PV change and returns available on other investments vary also. Previously, the population of investors were assumed to be linearly distributed between minimum and maximum hurdle rates, with 0% of the investor population falling outside these boundaries. This mechanism has been adjusted so that investors' hurdle rates are normally distributed, with the 95% of investors falling between minimum and maximum boundaries, with the rest lying beyond these. We believe this more accurately reflects the distribution of hurdle rates across the large population of potential FITs investors.

Previous hurdle rates were assumed to be linearly distributed between 1% and 12% for smaller scale domestic investors and 5%-8% for larger scale commercial and developer installations. Hurdle rates have now been split into 3 investor groups. These are real, pre-tax. These are:

- **small scale domestic** at (min – average -max) 3.5% - 8% - 12.5%,
- **medium scale commercial** at 5% - 8.5% - 12% and
- **larger scale developer/utility and aggregators** at 6.5% - 9% - 11.5%

In the previous version of the Solar PV model, all installations were assumed to export electricity for the export tariff. A further adjustment to the assumed revenue of solar PV investors is that >250kW insallations and stand alone are now assumed to negotiate their own export payments of 5/pkWh.

Revised cost assumptions. Costs and future cost reductions from PB's May 2012 update are now used in the modelling.

The model constructs a distribution of levelized costs[12] based on investor hurdle rates (as described above) and estimated capital and operating costs. Previously, this distribution was based on only a single point of capital and operating costs (e.g. central estimated costs in a central costs scenario). The model now uses the range of costs provided by PB and the assumed distribution of hurdle rates in constructing the levelized costs distribution.

PB also provided DECC with a range of cost reduction scenarios (slow, central, fast). The main sensitivities in the new model are based on these cost reduction scenarios, which are applied to the whole distribution of assumed installation costs in each case.

PB's range of low and high costs are based on the first and third quartiles respectively of PB's sample, i.e. 50% of the sample of installation prices gathered by PB are within the low – high range. While this is a good reflection of the variability of current solar PV costs, it is likely that there will be less variability in costs going forward, as the proposed degression mechanism places the solar PV industry on a more predictable footing, allowing increased competition between installers and consumer awareness to develop. In order to account for

[12] Levelized costs are calculated by dividing the discounted sum of costs by the amount of energy produced to give a £/MWh figure.

decreased variability of costs in the future, it is therefore assumed in our modelling that 95% of all installations fall within the low/high costs range estimated by PB in the period to 2020.

Deployment starting point. The model forecasts deployment from August 2012 onwards, and so an assumption is necessary to cover the April – July period. A range of assumed deployment during this period is set out in table 6 below. These are used for sensitivities, with the lower deployment feeding into the slow cost reduction scenarios and high deployment feeding into fast cost reduction scenarios.

A move to modelling on a monthly basis. The model previously averaged tariffs and installation costs over each year. This meant that large potential disparities between tariffs and costs were averaged out, limiting the model's ability to project within-year changes in deployment in response to more frequent tariff changes. The model now forecasts monthly deployment based on a month by month forecast of costs and tariffs, making it more responsive to changes in tariffs and costs in year.

The energy efficiency requirement. This is modelled on a similar basis as in the Phase 1 impact assessment. It is assumed that the requirement reduces available technical potential for deployment by 40% in 2012/13, 25% in 2013/14 and by 10% from 2014-15 onwards.

The dampening effect for 2012/13 is based on English Household Survey data which suggests that the proportion of houses currently at or above Band D is just under 50%, while slightly more non-domestic building were at this level. The dampening effect is assumed to fall steeply over this period reflecting the fact that level D is relatively easy to meet, and that FITs should encourage take-up of these measures.

28. Whilst the updated model and revised assumptions are expected to provide more robust projections of future solar PV uptake and associated costs, it should be noted that there is still a large amount of uncertainty in technology costs and investor hurdle rates. This together with the fact that FITs is a market-led scheme, mean that projections of future uptake will remain uncertain. This impact assessment therefore performs sensitivity tests in order to provide a range around possible future impacts.

<u>Deployment to date – Budget implications</u>

29. The 2010 Spending Review set an overall cap for all of DECC's tax and spending through policies that entail levy-funded spending (currently FITs, RO and WHD). This cap is managed though the levy control framework (LCF).

30. DECC is expected to set policy such that the central forecast for DECC levy-funded spending is equal to or less than the agreed cap. However, recognising the inherent difficulty of managing demand-led levy-funded policies, the Treasury have agreed at the outset a range of acceptable headroom above the cap, initially set at 20% of the total levies cap, which will represent the level of permissible variation before DECC has to develop urgently plans for bringing policies back into line with the cap. DECC is able under the LCF to maintain the levy-funded spending within the acceptable headroom so long as the additional spend is not the result of intended policy changes and an agreed plan for addressing the overspend is in place.

31. Where spend exceeds or is projected to exceed the range of acceptable headroom, DECC must rapidly agree with the Treasury a plan for bringing spending back down to the agreed profile. This plan will set out the adjustments that DECC proposes to make to its policies to reduce their spend, and the impact by year of taking action. The absence of an effective plan in this situation could ultimately result in the Treasury refusing DECC permission to retain all

or part of the tax income received above the agreed cap, which would leave DECC to fund all or part of the spending gap from within its Departmental Expenditure Limit.

32. Based on projections developed at the time of the Comprehensive Spending Review, the overall LCF cap was split between FITs, the Renewables Obligation, and the Warm Home Discount as shown in Table 5 below. DECC has to manage these policies so as to meet the overall levy control envelope as described above, but has flexibility to adjust the budgets for each policy within the overall cap, subject to continuing to meet policy objectives and value for money considerations.

Table 5: Feed in Tariffs budget plus overall Levy Control Framework envelope for Spending Review period

Budget (nominal, undiscounted, £m)	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**CSR period**
Feed in tariffs – all technologies	94	196	328	446	1,064
RO Spending Review Envelope[13]	1,750	2,156	2,556	3,114	9,576
Warm Home discount	250	275	300	310	1,135
Total levies control envelope	2,094	2,627	3,184	3,870	11,775

33. This Government response is determining tariffs from August 2012. In order to estimate the amount of FITs spend to date, assumptions for the April – July 2012 period are combined with observed deployment to end March 2012.

34. Table 6 presents these near term forecasts, whilst table 7 gives total committed spend to end of July 2012. Any overspends, and budget for any new deployment beyond July 2012, relies on underspends being available or generated from other schemes that fall within the LCF (the RO and WHD) and accessing, as a last resort and with the agreement of the Treasury, the headroom facility that has already been agreed in principal with HMT.

Table 6: Estimated PV deployment April - July 2012[6]

Deployment - PV only, MW	Deployment to end March 2011/12	Estimated deployment in April - July	Estimated total deployment at end July 2012/13
Central	1,148	220	1,368
Low	1,148	135	1,283
High	1,148	355	1,503

[13] The FITs and RO budget lines have been adjusted from those published at the time of the spending review to account for overlap between the two schemes, where generating stations below 5MW can choose to accredit against the RO or FITs. This is purely a technical adjustment in order to provide a more accurate picture of the spending limits for each policy, and has no impact on the total amount of subsidy available for these levies schemes. It should also be noted that the size of this overlap is not fixed, as it depends on how generators choose to accredit; the calculation may therefore be revisited in future.

Table 7: Estimated subsidy costs associated with PV installations to end July 2012

Committed Costs - PV only		*£m, nominal, undiscounted, actual*				
		2011/12	**2012/13**	**2013/14**	**2014/15**	**CSR**
Committed costs to end 2011/12		£136	£417	£429	£439	£1,421
Estimated additional committed spend from April - July deployment	Central	£0	£25	£40	£41	
	Low	£0	£17	£25	£25	
	High	£0	£39	£65	£66	
Estimated committed spend from deployment to end July 2012	**Central**	**£136**	**£442**	**£469**	**£480**	**£1,528**
	Low	£136	£434	£454	£464	£1,488
	High	£136	£456	£494	£505	£1,591

35. These central/low/high committed deployment estimates are used as the starting points for the central/slow/fast future cost reduction scenarios below respectively.

E: Options under consideration

36. Options considered here are:

(i) **Option 1: 'Do nothing'** – tariffs remain as set out in the Government Response to the Phase 1 consultation i.e. new tariffs in April 2012 as set out in table 1 above from an eligibility date of 3 March 2012. Tariffs are not degressed and remain constant in real terms. Multiple installation tariffs are set at 80% of equivalent single installation tariffs. Export tariff is 3.2p/kWh and tariff lifetime is 25 years.

(ii) **Option 2:** Introduce new tariffs from **1 August 2012**, set the multiple installation tariff at 90% of single installation tariff, introduce contingent degression mechanism, reduced tariff lifetime (20 years) and increased export tariff (4.5p/kWh).

Tariffs

The Phase 2A consultation set out a proposal for PV tariffs from July, with a range of options, based on deployment in March and April, following the 3 March reference date:

- **Option A** targeted average rates of return under PB's central cost scenario of around 4.5 to 8%, with around 5% for domestic installations. Under February cost/policy assumptions, this produced a tariff of **13.6p** for ≤4kW installations, with an estimated return on investment ('ROI') ranging from 0.5% under the "high" end of PB's predicted costs, and 10% with "low" end costs. This option was preferred if deployment during March (post 3 March eligibility date) and April 2012 exceeded 200 MW.
- **Option B** reduced tariffs by around 25% from the 1 April levels by 1 July, and yielded average ROIs of between 4.5-8% for most bands under PB's previous central cost scenario (and ROIs higher than 8% for the largest two bands). This produced a tariff of **15.7p** for ≤4kW installations, with a mid-range ROI of 6% (ranging from 1% to 11%). This option was preferred if deployment during March and April 2012 was between 150 and 200 MW.
- **Option C** was based on a cut of around 21% from April. This produced a tariff of **16.5p** for ≤4kW installations, with a mid-range ROI of 6%. This option was preferred if deployment during March and April 2012 was less than 150 MW.

37. Table 8 below shows the proposals for July 2012 tariffs for all bands from the Phase 2A consultation and the Phase 2a Government response August 2012 tariffs:

Table 8: Comparison of Phase 2a consultation and Government response tariffs

Generation tariffs, p/kWh, 2012 values,				
Tariff band (kW)	Phase 2a consultation Option A – July 2012	Phase 2a consultation Option B – July 2012	Phase 2a consultation Option C – July 2012	Phase 2a Government response - August 2012
4kW or less	13.6	15.7	16.5	16.0
>4-10kW	10.9	12.6	13.2	14.5
>10-50kW	9.9	11.4	11.9	13.5
>50-150kW	7.7	9.7	10.1	11.5
>150-250kW	5.8	8.0	10.1	11.0
>250kW-5MW	4.7	6.8	7.1	7.1
stand alone	4.7	6.8	7.1	7.1

38. The Government has decided to set tariffs similar to those under consultation option C, taking into account new evidence on costs that have been presented as part of the consultation and the changes to export tariffs and tariff lifetime. The new tariffs also reflect the revised assumptions on investor hurdle rates, and now target ROIs towards the higher end of the 4.5–8% range. Subject to the parliamentary process required by the Energy Act 2008, these tariffs will apply to new PV installations with eligibility dates on or after 1 August 2012.

39. Tariffs for multiple installations ('aggregators') are set at 90% of the individual tariff based on new evidence from PB that aggregator capex is typically 90% of that for single installations. PB had previously estimated aggregator costs to be 35% lower than individual installation costs and the consultation had conservatively set the aggregator tariff at 80% of the individual rate in light of considerable uncertainties around aggregator costs.

40. The Government has also decided to set the tariff for installations that fail the energy efficiency requirement to be the same as the stand-alone tariff for installations with the same eligibility date (7.1p/kWh from 1 August). The full range of tariffs is shown in Table 9 below:

Table 9: Full FITs tariff table under Option 2

Band (kW)	**Standard generation tariff** (p/kWh)	*Typical ROI[1] (%)*	**Multi-installation tariff** (p/kWh)	**Lower tariff** (if energy efficiency requirement not met) (p/kWh)
≤4kW (new build)	16.0	*6.3%*	14.4	7.1
≤4kW (retrofit)	16.0	*6.3%*	14.4	7.1
>4-10kW	14.5	*7.2%*	13.05*	7.1
>10-50kW	13.5	*7.2%*	12.15	7.1
>50-100kW	11.5	*6.8%*	10.35	7.1
>100-150kW	11.5	*6.8%*	10.35	7.1
>150-250kW	11.0	*7.4%*	9.9	7.1
>250kW-5MW	7.1	*7.9%*	N/A	N/A
stand-alone	7.1	*4.6%*	N/A	N/A

* From 1 August, solar PV tariffs will be specified to two decimal places, to avoid the accumulation of errors over time as tariffs are changed through degression and index-linking

Contingent Degression

41. Deployment of Solar PV depends on many factors including installation costs, investor hurdle rates, non-FITs revenue like bill savings, and wider economic considerations such as disposable income, cost of capital, and alternative investment opportunities. Some of these factors are challenging to estimate today and even more difficult to forecast into the future. In addition, some of these factors, especially costs, are very sensitive to market conditions and can be volatile in the short term.

42. Previous FITs policy was to base tariffs on expected ROIs by forecasting these factors, with annual reviews to keep this in check and allow a reasonable level of deployment whilst maintaining value for money. However, it has become apparent that adjusting tariff degression once a year was insufficiently responsive to changes in the deployment factors described above.

43. The Phase 2A consultation proposed a set of new tariffs for July 2012 together with a first formal degression of 5% at 1 October 2012. This October degression would then be followed by a schedule of 6-monthly 'automatic degressions' of 10% in nominal tariffs. In addition, the consultation proposed that 'contingent degression' would provide scope for degression steps to be brought forward (with two months notice before taking effect) if deployment exceeds pre-determined levels. The consultation proposed that the expected levels of deployment should be published in advance by DECC and the measure of actual deployment at any given point to be determined by Ofgem, based on their analysis of the central FIT register, the MCS database and other information they consider relevant, and published on a monthly basis.

44. The PV cost control proposals remain fundamentally similar to those on which we consulted in February, but we have been refining the detail to take account of a number of practical considerations and stakeholder responses.

45. These modifications to our original proposal are expected to provide both greater budgetary control, as tariffs would respond more rapidly to changes in deployment, and greater certainty to industry, as they could plan with greater confidence about when tariffs would change. The key features are:

    - smaller, more frequent tariff changes at fixed dates (3-monthly instead of 6-monthly);
    - baseline degression of 3.5% per quarter, with larger cuts (to a maximum of 28%) depending on the rate of deployment;
    - tariff cuts will be 'skipped' (for up to two quarters) if deployment is low;
    - three degression 'bands' (domestic, small commercial and large commercial/utility), with deployment in each band determining the future tariff in that band.

46. Degression will occur at 3-monthly intervals (in May, August, November and February). Tariffs at each degression point will depend on observed deployment in the 3 month period ending 3 months before the degression date (e.g. the first November 2012 degression will depend on deployment in the May – July 2012 period). Tariffs will be degressed every 3 months according to the parameters set out in table 10. Table 20 in the 'Sensitivities' section below sets out how the contingent degression mechanism would be expected to work under slow, central and fast cost reduction scenarios.

Table 10: Contingent degression bands and thresholds

Degression point	Degression (%)	Max deployment (MW)		
		<10kW	10kW < 50kW	>50kW
Point 1	0%	100	50	50
Point 2	3.50%	200	100	100
Point 3	7%	250	150	150
Point 4	14%	300	200	200
Point 5	28%	>300	>200	>200

47. The system of contingent degression above has been designed to allow deployment to grow steadily under all three of PB's projected cost reduction scenarios, whilst maintaining costs to consumers of the FITs scheme within certain boundaries.

48. However, no contingent degression mechanism can completely protect the budget from a sudden surge in deployment, and it is also possible that if costs or hurdle rates are outside of our modelled ranges, the mechanism could under- or over-correct tariffs. Over time, it is expected that under or over corrections will be ameliorated by skipping degressions or by having a series of very high degressions, but we will also review the mechanism on a regular basis to ensure that it is operating in line with expectations.

49. If deployment is relatively low in some groups, the contingent degression mechanism is designed with the aim of ensuring that tariffs in these bands do not degress to such an extent that deployment in these bands remains muted. This would allow the ROIs for these bands to increase as costs decrease until the RoI reach the necessary level to incentivise deployment in these bands.

Decreased tariff lifetime

50. The Phase 2A consultation noted that when the FITs scheme was introduced, PV tariffs had a 25 year lifetime while most other technologies were set at 20 years. The consultation questioned whether this discrepancy remained appropriate and proposed reducing the tariff lifetime for new PV entrants to the FITs scheme from 25 to 20 years.

51. Responses to the consultation were divided on this proposal. However, we continue to believe that, on balance, there is a case for reducing the tariff lifetime for new PV installations to better align it with other technologies eligible for FITs as well as the RO. As set out in the consultation, at any given tariff rate, while a shorter tariff lifetime would reduce implicit rates of return, this would not be to a great extent (see table 11 below). Therefore, it is unlikely to have a significant impact on peoples' investment decisions. However, this will have a significant impact on the lifetime cost to consumers, reducing estimated electricity bills relative to the do nothing case.

52. The impact of reducing the tariff lifetime to 20 years for PV installations from 1 August 2012 is included when calculating ROIs and projecting deployment from August.

Increased export tariff

53. The consultation confirmed that the review of FITs has been seeking to establish whether the level of export tariff continues to reflect the real value of FITs exports; and to consider the way in which exports are treated in the levelisation process, in order to ensure that electricity suppliers are neither under or over compensated.

54. The consultation highlighted how preliminary analysis of the key data on which these estimates are based, suggested that the underlying value of electricity either to suppliers or as spill is greater than implied by the current export tariff (now 3.2p/kWh following indexation for 2012/13). In the light of this, views were sought on whether the current level of the export tariff fairly represents the value to suppliers of exports from FITs generation. The consultation also proposed that any change to the export tariff would apply only to new entrants to the FITs scheme and asked for views on this and on whether a change in the export tariff should result in compensating changes to generation tariffs, in order to broadly maintain the rate of return.

55. Based on further analysis and consultation feedback, we continue to believe that the current export tariff does not reflect the value of FITs exported electricity. We have therefore decided to increase the export tariff to 4.5p/kWh and to review the level of the export tariff on an annual basis.

56. The "system sell price" (the price paid by the system operator for generation spilled onto the system) represents the best estimate for the value of deemed electricity exports, which represent the majority of exported electricity from solar PV installations (all installations with a total installed capacity of 30kW or less are 'deemed' to export 50% of electricity generated). In 2011, the average system sell price was 4.1p/kWh, and this has been increasing in recent years in line with wholesale electricity prices. We therefore believe that 4.5p/kWh represents a fair value for such deemed exports..

57. Feedback from the consultation has reinforced our concern that applying an increase in the export tariff to both existing and new generators could result in a windfall gain to existing generators who are already benefiting from high generation tariffs. Therefore, while we recognise the arguments in favour of having a single export tariff we do not feel we can justify this and have therefore decided that the new export tariff should apply only to new generators with an eligibility date on or after 1 August 2012.

58. As in the past, the new export tariff has been applied in calculating the new generation tariffs for solar PV, as it is relevant to determining what tariff is necessary to provide a particular rate of return.

Index-linking

59. The Government has decided to maintain RPI index-linking of generation tariffs. This is in line with the views of the vast majority of respondents to the consultation, who argued that removing index-linking would take away much of the underlying attraction of the FIT scheme. Moreover, scheme costs over the short term could increase if tariffs need to be adjusted to compensate for the change in ROI.

Default rate for installations that do not meet the energy efficiency requirement

60. The Government has decided to that installations that do not meet the energy efficiency requirement should receive the same tariff as stand-alone installations with the same eligibility date, rather than 9p/kWh as at present. If the default tariff was not changed, the differential between the tariffs for installations that do and do not meet the energy efficiency requirement would be reduced as tariffs come down, reducing the incentive for energy efficiency improvements. This means that from 1 August, such installations will receive a tariff of 7.1p/kWh. We have not modelled ROIs or uptake by investors who choose not to meet the energy efficiency requirement and receive the lower tariff instead.

Change to threshold to become a mandatory licensee

61. The Phase 2B consultation asked whether the threshold at which suppliers become mandatory FITs licensees should increase from 50,000 customers to 250,000 to bring it into line with other environmental programmes, CESP and CERT, which were increased in 2010. It was understood that this would be consulted on for FITs as part of the Review. At the start of the current FITs year in April, two licensees went over the 50,000 threshold and became mandatory licensees on 1 April although they are not set up for it. In response to their representations and no adverse comments from other respondents to that question, we propose to make the change in August alongside the 2A changes rather than wait until October to minimise the length of time these companies will remain as mandatory licensees.

62. The change to the threshold is not expected to have any impact on ROIs, costs and deployment.

Impact of decisions

63. Table 11 shows how each decision on lifetime and export tariff affects ROI in turn and then cumulatively whilst keeping generation tariffs fixed. Decreasing tariff lifetime reduces ROI whilst increasing the export tariff increases ROI. Installations >250kW and stand alone are assumed to negotiate their own export payments greater than the export tariff, and so the change in export tariff is not expected to affect them. Switching to a 20 year tariff life and increasing the export value to 4.5p/kWh has a cumulative effect of slightly lowering ROI in all bands for a given generation tariff. Note that "Stand alone" ROIs are expected to be lower than other bands as these installations are expected to export 100% of the generated electricity at the export value, whereas other installations will offset some generation against imported electricity at the greater retail price, thus increasing ROIs.

Table 11: Impact on ROIs of varying tariff lifetime, export tariff

ROI	Lifetime years	25	20	25	**20**
	Export p/kWh	3	3	4.5	**4.5**
Band	Tariff p/kWh	A	B	C	**D**
<4kW	16.00	6.7%	6.0%	7.0%	**6.3%**
4kW - 10kW	14.50	7.5%	6.9%	7.8%	**7.2%**
10kW - 50kW	13.50	7.5%	6.8%	7.8%	**7.2%**
50kW - 150kW	11.50	7.1%	6.4%	7.4%	**6.8%**
150kW - 250kW	11.00	7.6%	7.0%	8.0%	**7.4%**
250kW - 5MW*	7.10	8.5%	8.0%	8.5%	**8.0%**
Stand alone*	7.10	5.1%	4.6%	5.1%	**4.6%**

* 250kw-5MW and Stand alone are assumed to received an export payment of 5/pkWh under both export tariffs.

F: ANALYSIS OF COSTS AND BENEFITS

64. The analysis presented below quantifies some of the costs and benefits related to Solar PV deployment under FITs. Cost to consumers is considered separately to resource costs as these are considered to be transfers of value rather than a cost or benefit to society[14]. Resource costs include the foregone investment opportunities resulting from the capital and operating costs of an installation and the resulting fuel savings from an installation compared to a CCGT counterfactual; these are netted off against the value of carbon benefits from offset generation to give the Net Present Value (NPV) for a particular option. This IA only considers the costs of electricity generated under the FITs scheme (i.e. it does

[14] Implicitly assuming no changing marginal utility from changes in income resulting from FITs revenue or increased bills.

not consider the electricity generated from Solar PV coming on under RO). Key non quantified costs/benefits include:

- The additional cost to households of meeting the energy efficiency requirement e.g. cost of obtaining an EPC certificate (both in terms of time and money).
- The additional benefits to society or households of any energy efficiency improvements as a result of the EPC requirements.
- any change in the variable administration costs of the FITs scheme linked to a change in solar PV uptake.
- The impact of changes in solar PV generation on the transmission and distribution networks.
- Security of supply (diversity of supply, system balancing).
- Behavioural change benefits resulting from consumers' increased consciousness of their energy consumption as a result of installing solar PV

Option 1, Do Nothing – Cost benefit analysis and deployment

65. Table 12 below gives deployment, number of installations, cost to consumers and cost benefit analysis metrics for Option 1, Do Nothing. As set out in paragraph 36, this policy assumes that tariffs remain as set out in table 1 above with no degression, tariff lifetime remains at 25 years and that the export value remains at 3.2p/kWh. Sensitivities around these central forecasts are presented in the next section.

Table 12: Deployment, costs and benefits, Do Nothing central cost reduction scenario

Do nothing - central cost reduction scenario		2012/13	2013/14	2014/15	2020/21	Lifetime
Deployment	MW, cumulative	2,400	4,900	8,600	38,400	
Installations	'000s, cumulative	700	1,300	2,100	7,700	
FITs cost to consumers	£m, Real 2010, discounted	420	620	980	3,420	68,800
Resource costs	£m, Real 2010, discounted	100	200	310	680	14,400
carbon benefits	£m, Real 2010, discounted	10	20	30	250	6,300
Net present value	£m, Real 2010, discounted	-100	-180	-270	-440	-8,100

Values may not sum due to rounding

66. Under this Do Nothing option with central cost reduction strong growth of PV to 2020/21 is forecast. Deployment is estimated to be 38GW by 2020, or 8 million installations. This high level of deployment comes at an extremely high cost to consumers – with tariffs as described expected to add an additional £3,000m to consumer bills in 2020/21 (on top of the £400m already committed as set out in table 7 above), and nearly £70,000m over the lifetime of the generation tariffs. As well as an extremely high cost to consumers, the do nothing policy is expected to have a very negative NPV (-£8.1bn).

67. The do nothing scenario here compares to the proposed option in the IA for the Government response to Phase 1 of the Government response[15]. The differences in results here demonstrate the key changes in assumptions on market barriers and hurdle rates between the previous IA and this final IA. A comparison of the results in Table 12 above against results from the consultation IA show:

- 2020 deployment is higher than in the consultation IA as a result of looser supply constraints which mean that more PV is assumed to be deployed for the same tariffs

[15] Available at http://www.decc.gov.uk/assets/decc/Consultations/fits-review/4310-feedintariff-comprehensive-review-phase-1-impact.pdf.

- Net resource costs are higher in these new estimates – stemming mostly from the slower assumed reductions in costs in the longer term.
- Overall the measures have a long term cost, rather than a long term benefit – as the costs of PV are not assumed to fall as fast to 2020 as under Phase 1. Therefore there is less cost-effective PV in the new resource cost calculations, leading to a negative NPV overall.
- New estimates have higher subsidy costs to 2020 than in the previous impact assessment, stemming from the higher modelled deployment.

68. These differences in deployment and costs demonstrate the impact that uncertainty over future costs have on the cost of the Feed in Tariff scheme. The uncertainty in costs was highlighted both in the Phase 1 and Phase 2a impact assessments, which presented a range of costs based on different cost assumptions. In the 'Sensitivities' section below we have provided a similar range of uncertainty, which shows the sensitivity of results to a range of assumptions.

69. Table 13 gives expected ROIs [16]under the Do Nothing option with central cost assumptions. ROI's are expected to increase over the period, offering investors excessive profits. This would drive the very high levels of uptake observed in table 12 above.

Table 13: Tariffs and ROIs, Do Nothing central cost reduction scenario

Tariffs and ROI, Do nothing, Central cost reduction		**Jul-2012**	**Jan-2013**	**Jan-2014**	**Jan-2015**
Tariffs, nominal	<4kW retrofit	21.00	21.00	22.05	22.70
	4 - 10kW retrofit	16.80	16.80	17.64	18.16
	10 - 50kW retrofit	15.20	15.20	15.96	16.43
	50-150kW retrofit	12.90	12.90	13.54	13.94
	150-250kW retrofit	12.90	12.90	13.54	13.94
	250-5000kW retrofit	8.90	8.90	9.34	9.62
	Stand alone	8.90	8.90	9.34	9.62
ROI	<4kW retrofit	8.9%	9.3%	11.1%	12.2%
	4 - 10kW retrofit	8.6%	9.2%	11.1%	12.2%
	10 - 50kW retrofit	8.4%	9.0%	10.9%	12.0%
	50-150kW retrofit	7.9%	8.4%	10.3%	11.3%
	150-250kW retrofit	8.8%	9.4%	11.4%	12.5%
	250-5000kW retrofit	9.4%	10.0%	12.2%	13.3%
	Stand alone	5.6%	6.1%	7.5%	8.3%

Option 2 – Cost benefit analysis and deployment

70. Table 14 below gives deployment, number of installations, cost to consumers and cost benefit analysis metrics for Option 2 under central deployment and cost reduction assumptions.

[16] To note that the RoI is calculated according to methodology as set out in Annex C.

Table 14: Deployment, costs and benefits, Option 2 central cost reduction scenario

Option 2 - central cost reduction scenario		2012/13	2013/14	2014/15	2020/21	Lifetime
Deployment	MW, cumulative	1,900	2,900	4,200	11,900	
Installations	'000s, cumulative	500	800	1,000	2,600	
FITs cost to consumers	£m, Real 2010, discounted	390	460	530	660	12,700
Resource costs	£m, Real 2010, discounted	80	140	180	240	5,600
carbon benefits	£m, Real 2010, discounted	10	10	20	80	2,000
Net present value	£m, Real 2010, discounted	-80	-130	-160	-170	-3,600

Values may not sum due to rounding

71. To end 2011/12 there was **1.1GW** of deployment at a full year annual cost to consumers of over **£400m**. Under option 2, cumulative Solar PV deployment is expected to reach 11.9GW at a total cost to consumers of £700m per year in 2020/21. This over **10GW** of additional deployment is therefore expected to have additional real cost to consumers of around **£300m** per year by 2020/21 This shows the greater value for money achieved from lower cost installations receiving lower generation tariffs.

72. At **11.9GW** the central 2020 deployment projection is considerably less than the central estimate in the draft February Phase 2A IA at **22GW**. This is largely because PB's estimate for the cost of large scale PV installations is significantly higher than in their February report, and PB projects much slower reductions in installation costs from 2014 onwards than previously estimated. Furthermore, it is assumed that investor hurdle rates are higher than before, leading to less uptake at a given tariff. The sensitivity of deployment to these assumptions is analysed through scenarios in the "Sensitivities" section below. This shows a possible range of deployment of 3.5GW to 21.1GW in 2020.

73. Overall the number of installations predicted by 2020 are around 2.6m – lower than the 3.3m predicted in the 2A impact assessment. Installation estimates are however proportionately much higher, due to the modelling now suggesting a much higher proportion of smaller installations than before. This is again due to greater estimated larger scale installation costs and lower estimated smaller scale installation costs.

74. The comparative picture for the short term estimates of deployment and costs are slightly different than the longer term picture. In the short term, the looser market barriers lead to a higher prediction of deployment in 2012/13. This leads to a higher estimate of new deployment, new installations and costs from new installations across the levy control period than in the consultation impact assessment. To note, cost estimates are not strictly comparable as they are now modelled using monthly deployment estimates, and are more accurate than those in the previous IA. Further sensitivities are presented in the next section

75. Table 15 gives expected tariffs at the start of each year associated with this central scenario and associated ROIs. In the <4kW band, under central cost reduction, tariffs are expected to degress by 3.5% each 3-month degression period, or around 13% a year up to 2014/15, with some higher degressions towards the end of the CSR period. Uptake for larger scale installations is estimated to be slower than for smaller installations, triggering fewer reductions in tariffs over the period.

Table 15: Projected tariffs and ROIs, Option 2 central cost reduction scenario

Option 2 - Tariffs and ROI, Central cost reduction		Aug-2012	Feb-2013	Feb-2014	Feb-2015
Tariffs, nominal	<4kW retrofit	16.00	14.90	12.92	10.41
	4 - 10kW retrofit	14.50	13.50	11.71	9.43
	10 - 50kW retrofit	13.50	13.50	11.71	9.43
	50-150kW retrofit	11.50	11.50	10.71	9.29
	150-250kW retrofit	11.00	11.00	10.24	8.88
	250-5000kW retrofit	7.00	7.10	6.61	5.73
	Stand alone	7.10	7.10	6.61	5.73
ROI	<4kW retrofit	6.3%	6.3%	6.7%	6.2%
	4 - 10kW retrofit	7.2%	7.3%	7.9%	7.5%
	10 - 50kW retrofit	7.2%	7.8%	8.3%	7.6%
	50-150kW retrofit	6.8%	7.4%	8.5%	8.3%
	150-250kW retrofit	7.4%	8.0%	9.2%	8.9%
	250-5000kW retrofit	7.9%	8.6%	10.0%	10.0%
	Stand alone	4.6%	5.1%	5.8%	5.4%

Risks and Assumptions

76. The estimates of costs and deployment above are based on a number of key assumptions: PV costs (based on estimates of PV costs from PB's latest update[17]); DECC's electricity price projections[18]; and assumptions as to how fast the PV industry can grow, both to the end of July 2012, and beyond. PV uptake from August 2012 onwards has been estimated with DECC's new model for solar PV using new PV costs and market growth assumptions.

77. There is considerable uncertainty surrounding many of the underlying assumptions, particularly around current and future costs, given how quickly the PV market is changing at the moment. To reflect this uncertainty, PB's latest update gives High, Central and Low values for current costs, and three scenarios for future cost reduction. Sensitivities have been modelled around these cost reduction scenarios on both Do nothing and Option 2, and are set out in the 'Sensitivities' section below in tables 16 – 19.

78. In addition to uncertainty around costs, there is considerable uncertainty around investor hurdle rates. Investor hurdle rates determine what proportion of potential investors are incentivised to install Solar PV. Tables 21-22 show additional sensitivities on investor hurdle rates.

Sensitivities

79. The tables below set out the impact of changes in the speed of cost reduction on uptake and costs[19] under Do Nothing and option 2. These sensitivities are the ones used on the front summary sheet and in table 23 below.

[17] Parsons Brinckerhoff April update ref, ibid

[18] See http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx

[19] The scenarios also include the sensitivity on April – July 2012 deployment as given in table 6 above. This has a relatively minor impact on deployment and costs over the decade but is important for comparison of budgets in Annex A. Lower April-July 2012 deployment is assumed in the slow learning rates scenarios and higher deployment is assumed in the fast learning rates scenarios.

Tables 16-19: Deployment, costs and benefits under fast/slow cost reduction scenarios, central hurdle rates

Table 16

Do nothing - slow cost reduction scenario		2012/13	2013/14	2014/15	2020/21	Lifetime
Deployment	MW, cumulative	2,100	3,700	6,000	25,400	
Installations	'000s, cumulative	600	1,000	1,600	5,600	
FITs cost to consumers	£m, Real 2010, discounted	400	550	770	2,380	48,400
Resource costs	£m, Real 2010, discounted	100	190	290	920	20,800
carbon benefits	£m, Real 2010, discounted	10	10	20	160	4,200
Net present value	£m, Real 2010, discounted	-90	-170	-270	-760	-16,600

Values may not sum due to rounding

Table 17

Do nothing - fast cost reduction scenario		2012/13	2013/14	2014/15	2020/21	Lifetime
Deployment	MW, cumulative	2,800	6,300	11,600	44,800	
Installations	'000s, cumulative	700	1,600	2,800	8,600	
FITs cost to consumers	£m, Real 2010, discounted	440	720	1,220	3,900	78,300
Resource costs	£m, Real 2010, discounted	110	210	270	200	2,600
carbon benefits	£m, Real 2010, discounted	10	20	50	290	7,400
Net present value	£m, Real 2010, discounted	-100	-180	-230	90	4,800

Values may not sum due to rounding

Table 18

Option 2 - slow cost reduction scenario		2012/13	2013/14	2014/15	2020/21	Lifetime
Deployment	MW, cumulative	1,700	2,300	3,000	6,400	
Installations	'000s, cumulative	500	600	800	1,600	
FITs cost to consumers	£m, Real 2010, discounted	380	420	460	520	10,200
Resource costs	£m, Real 2010, discounted	80	130	160	260	6,200
carbon benefits	£m, Real 2010, discounted	10	10	10	40	1,100
Net present value	£m, Real 2010, discounted	-80	-120	-150	-220	-5,100

Values may not sum due to rounding

Table 19

Option 2 - fast cost reduction scenario		2012/13	2013/14	2014/15	2020/21	Lifetime
Deployment	MW, cumulative	2,100	3,800	5,500	16,000	
Installations	'000s, cumulative	600	900	1,200	3,100	
FITs cost to consumers	£m, Real 2010, discounted	400	490	580	590	11,700
Resource costs	£m, Real 2010, discounted	90	140	160	90	1,500
carbon benefits	£m, Real 2010, discounted	10	10	20	100	2,700
Net present value	£m, Real 2010, discounted	-80	-130	-140	10	1,100

Values may not sum due to rounding

80. Under do nothing, deployment to 2020 is expected to be between 25GW and 45GW, at a lifetime cost to consumers of between £48.4Bn and £78.3Bn. Under option 2 deployment to 2020 varies between around 6GW and 16GW with slow and fast cost reduction respectively – with lifetime cost to consumers ranging from £10.2bn to £11.7bn.

81. Lifetime cost to consumers is chiefly determined by two factors, deployment and tariffs. Lifetime cost to consumers is highest in the central cost reduction case. In the slow cost reduction scenario, deployment is less than in the central case but tariffs are higher. Deployment is the dominant effect and cost to consumers is lower than in the central case. In the fast cost reduction case, the opposite effect occurs. Deployment is substantially

greater than in the central case, but tariffs are much lower, leading overall again to a lower cost to consumers than in the central case.

82. The net present value (NPV) presented in each of the tables above is the value of the policy relative to a no FITs baseline (ie the absolute impact). The NPV is made up of the annualised resource costs of the installations (a proxy for foregone alternative investment opportunities), the cost of generating energy through alternative means (measured using the electricity wholesale price) and the value of carbon reductions. In the draft Phase 2a IA, central scenarios showed a positive NPV. In the central and slow cost reduction cases, the Do Nothing and Option 2 policies now have a negative NPV, ie resource costs outweigh carbon reductions over the lifetime of the policy. This is due to higher estimated costs for larger scale installations and slower cost reduction in these bands. There is still an estimated positive NPV in the fast cost reduction scenarios.

83. Table 20 gives expected <4kW tariffs under the 3 cost reduction scenarios above to 2014/15 under contingent degression. The colouring refers to table 10 above, showing which degression point applies in each case (eg blue is degression point 1: 0%, green is degression points 2: 3.5% etc).

Table 20: Tariff degression under Central, Slow, Fast cost reduction scenarios, central hurdle rate assumptions

Contingent degression scenarios	4kW or less								
	Central cost reduction scenario			Slow cost reduction scenario			Fast cost reduction scenario		
	MW*	Degression	Tariffs	MW*	Degression	Tariffs	MW*	Degression	Tariffs
Aug-2012			16.00			16.00			16.00
Nov-2012	172	3.5%	15.44	103	3.5%	15.44	283	14.0%	13.76
Feb-2013	118	3.5%	14.90	99.6	0.0%	15.44	142	3.5%	13.28
May-2013	125	3.5%	14.38	96	0.0%	15.44	134	3.5%	12.81
Aug-2013	135	3.5%	13.87	103	3.5%	14.90	163	3.5%	12.37
Nov-2013	155	3.5%	13.39	117	3.5%	14.38	204	7.0%	11.50
Feb-2014	167	3.5%	12.92	119	3.5%	13.87	241	7.0%	10.69
May-2014	179	3.5%	12.47	120	3.5%	13.39	268	14.0%	9.20
Aug-2014	195	3.5%	12.03	124	3.5%	12.92	304	28.0%	6.62
Nov-2014	205	7.0%	11.19	125	3.5%	12.47	289	14.0%	5.70
Feb-2015	204	7.0%	10.41	120	3.5%	12.03	209	7.0%	5.30

* Deployment is for the reference period (EG for Nov-2012, this is the May - July period) and is for deployment in the group, (IE all <10kW)

84. The table shows that depending on how quickly the costs of an installation come down, tariffs for sub-4kW installations could be as high as 12.03p/kWh in February 2015 or as low as 5.30p/kWh. The ROIs for these tariffs for the central case are presented in table 15 above. Tables of tariffs and ROIs for all bands under each policy option and each cost reductions scenario are presented in Annex E.

85. The above sensitivities are based on uncertainty surrounding cost reduction. To illustrate a wider range of uncertainty, scenarios based on high hurdle rate assumptions combined with low cost reduction (to give low uptake), and low hurdle rate assumptions combined with high cost reduction (to give high uptake) are presented. Central hurdle rate assumptions are given in paragraph 27 above. For the low run below, each hurdle rate distribution is shifted up by 2% (EG for small scale domestic installations, the range becomes 5.5% - 14.5%) and in the high scenario presented below each hurdle rate distribution is shifted down 2% (e.g. 1.5% - 10.5% for small scale domestic installations). These scenarios give a broader range

of Solar PV deployment in 2020 from 3.5GW to 21.1GW. These are only presented here as additional sensitivities and do not feed through to the summary front sheet.

86. These deployment scenarios assume no change in Government policy as solar PV costs come down, and do not reflect any deployment of solar PV under the Renewables Obligation. A key factor determining how much deployment there will be by 2020 is the point at which solar PV is viable without subsidy. Our modelling suggests that this point will not be reached for typical investors until well into the second half of this decade, although some industry observers believe this will happen sooner. If this took place, deployment by 2020 would be higher than projected here. The Government is also setting up a Cost Reduction Taskforce to help industry drive down costs faster.

Tables 21-22: Deployment, costs and benefits under additional hurdle rate sensitivities

Table 21

Option 2 - slow cost reduction, high hurdle rates		2012/13	2013/14	2014/15	2020/21	Lifetime
Deployment	MW, cumulative	1,500	1,700	2,000	3,500	
Installations	'000s, cumulative	400	500	600	1,000	
FITs cost to consumers	£m, Real 2010, discounted	370	380	390	400	8,100
Resource costs	£m, Real 2010, discounted	80	110	120	160	3,900
carbon benefits	£m, Real 2010, discounted	10	10	10	20	600
Net present value	£m, Real 2010, discounted	-70	-100	-110	-140	-3,300

Values may not sum due to rounding

Table 22

Option 2 - fast cost reduction, low hurdle rates		2012/13	2013/14	2014/15	2020/21	Lifetime
Deployment	MW, cumulative	2,600	4,700	6,700	21,100	
Installations	'000s, cumulative	700	1,100	1,500	3,900	
FITs cost to consumers	£m, Real 2010, discounted	410	540	600	550	10,900
Resource costs	£m, Real 2010, discounted	100	170	200	100	1,500
carbon benefits	£m, Real 2010, discounted	10	20	30	130	3,500
Net present value	£m, Real 2010, discounted	90	160	170	-30	-2,000

Values may not sum due to rounding

Summary – Comparison with a 'do nothing' scenario

87. Table 23 presents the total cost of Option 2 and compares this against the costs of the Do Nothing option under slow, central and fast cost reduction scenarios (i.e. referring to tables 16-19 above). It first summarises lifetime resource costs and carbon benefits for each option under slow, central and fast cost reduction. The third block gives the absolute NPV of each option under the three cost reduction scenarios relative to no FITs. The central and slow cost reduction scenarios are expected to have a negative NPV (ie a cost to society) under both options. The fast cost reduction scenario is expected to have a positive NPV (ie a benefit to society). The second table then compares the two options. Under central and slow cost reduction, the cost to society of Option 2 is less than do nothing, and so the policy has a positive NPV relative to the counterfactual do nothing option.

88. Under fast cost reduction, option 2 has a higher cost to society than the do nothing option, and so the policy has a negative NPV relative to the do nothing option. This is because under fast cost reduction PV becomes cost-effective earlier, such that incentivising cost-effective PV will lead to lower overall resource costs (although the Do Nothing option will still have much higher subsidy costs, and a greater impact on consumer bills).

Table 23: Comparison of Do Nothing and Option 2

	Absolute values, i.e. relative to no FITs					
	Resource costs		Carbon Benefits		Present Value of Option	
Value estimates (Real £2010, discounted, £m)	Do nothing	Option 2	Do nothing	Option 2	Do nothing	Option 2
Best (central cost reductions)	14,400	5,600	6,300	2,000	-8,100	-3,600
High (slow cost reductions)	20,800	6,200	4,200	1,100	-16,600	-5,100
Low (fast cost reductions)	2,600	1,500	7,400	2,700	4,800	1,100

	Difference of option 2 and do nothing		
Value estimates (Real £2010, discounted, £m)	**Costs**	**Benefits**	**Net**
Best (central cost reductions)	**-8,900**	**-4,300**	**4,500**
High (slow cost reductions)	**-14,600**	**-3,100**	**11,500**
Low (fast cost reductions)	**-1,000**	**-4,700**	**-3,700**

Values may not sum due to rounding

G: Other Issues

Further costs and benefit considerations for solar PV

89. In view of high potential cost impact of solar PV and the associated risk that this could absorb a high proportion of funding from the FITs scheme as a whole, it is important to consider whether there are wider policy justifications for including support for these installations in the FITs scheme. The FITs scheme is designed to promote take up of small-scale low-carbon electricity technologies by the public and communities as part of a portfolio approach to meeting the UK's renewable energy target that must be affordable in the context of the control framework for DECC levy-funded spending and provide value for money to consumers.

90. The FITs scheme is also intended to contribute to other low carbon goals. These wider aims are central considerations in justifying any level of subsidy that is above the cost per unit of energy generated considered necessary to meet the renewable energy target cost-effectively. These objectives are:

    a) Use decentralised energy to empower people and give them a direct stake in the transition to a low-carbon economy

    b) Help develop a supply chain that offers households a wide range of cost effective measures to lower their energy use and carbon emissions;

    c) Assist in public take-up of carbon reduction measures, particularly measures to improve the energy efficiency of buildings

91. In relation to a) engagement with energy generation could lead to behaviour change by individuals and communities in relation to energy use which will further reduce carbon emissions in addition to the reductions brought about by installing PV.

92. With respect to b), by allowing future solar PV uptake at an affordable level, while still providing attractive rates of return in the current investment climate, FITs will allow PV to reach the same (or higher) level of cost efficiency as other low carbon technologies, allowing for effective competition among a number of technologies to emerge and reducing the overall costs of reducing emissions.

93. In relation to c) by making the higher FITs tariff conditional on an energy efficiency requirement could incentivise households to take up energy efficiency measures sooner than they would otherwise have done so, which will lead to greater levels of cost-effective emissions reductions.

H: Wider Impacts

Equality assessment

94. The policy proposals have been screened for equality impacts. We consider that a decision on the options would not have a positive or negative effect on any particular protected characteristic. (or "equality strand"). We have therefore not undertaken a detailed Equality Impact Assessment.

Environmental Impacts

95. Under the central growth scenario, the 'no change' scenario is expected to deliver around 215MtC02 lifetime savings. Under option 2 this falls to around 69MtCO2. Therefore the net impact of the measure is to lead to an additional 146MtC02 lifetime emissions. However, carbon saved under the FIT scheme is in the traded sector and is capped by the EUETS.

96. Linking the Feed in tariff for solar PV with an energy efficiency commitment could encourage households to take up more energy efficiency measures, with associated carbon savings. The estimates of overall impact in this assessment do not quantify the benefits of any increase energy efficiency due to the scheme, as this is too uncertain to model accurately.

Sustainable development

97. The Feed in Tariff is aimed at increasing the deployment of small-scale renewable electricity generation in order to move the UK away from fossil fuel dependency towards a low carbon economy in preparation for a future when supplies of gas and oil will become tighter and more expensive. The option presented here could have a negative impact on sustainable development because it leads to lower deployment than under a 'no change' option.

Distributional Impacts

98. Changing the level of the feed in tariff affects the overall subsidy levels needed to support generation, and hence the cost of that support to consumers through the electricity bill. Table 12 above gives the subsidy costs of the Do Nothing option. Option 2 subsidy costs are in table 14 (central cost reduction), table 18 (slow cost reduction) and table 19 (fast cost reduction). Tables 24a and 24b below give the estimate of the impact on domestic and non-domestic electricity bills respectively of the cost of solar PV Feed in Tariffs, under the no change option, and for Option 2 under the different cost reduction scenarios, based on the subsidy costs above. These impacts have been measured against a 'no feed in tariff' scenario.

99. Under the Do Nothing option, the cost to domestic bills of solar PV would have been around £18 p.a. in 2015, and £46 p.a. in 2020 (real 2010 prices). Option 2 would reduce this cost to around £8 in 2015 and £9 in 2020. The do nothing scenario modelled here is the lead scenario set out in the Phase 1 government response – 21p for <4kw installations, no degression. The estimated bill impacts are higher than those estimated in the Phase 1 government response, due to changes in modelling assumptions set out in paragraph 27 above. Specifically the loosening of barriers to deployment, and lower hurdle rate assumptions mean that we are now modelling a higher level of take up under the do nothing scenario. This leads to higher subsidy costs, and consequently higher bill impacts.

100. The impact on bills under central and high cost reduction is similar to the bill impact from option C from the Phase 2A consultation. Under the central scenario option 2 here leads to lower deployment at a slightly higher cost to consumers than was modelled in the previous impact assessment. The senstivity here shows the impact of the fast cost reduction on the estimated bills – under the fast cost reduction sensitivity we see considerably higher deployment (around 16GW compare to around 12GW in the central), but with a similar impact on bills . This is because under the contingent degression mechanism tariffs respond to increased deployment, thus ameliorating the impact on consumer bills.

Table 24a: Estimated Impact on average Domestic Consumer Bills (central scenario)

Impact on average domestic electricity bill	**Do Nothing**		**Option 2 slow cost reduction**		**Option 2 central cost reduction**		**Option 2 fast cost reduction**	
	£/yr	%	£/yr	%	£/yr	%	£/yr	%
2011	**2**	**0%**	**2**	**0%**	**2**	**0%**	**2**	**0%**
2012	5	1%	4	1%	5	1%	5	1%
2013	8	1%	6	1%	6	1%	7	1%
2014	12	2%	6	1%	7	1%	8	1%
2015	**18**	**3%**	**7**	**1%**	**8**	**1%**	**8**	**1%**
2016	24	4%	7	1%	8	1%	9	1%
2017	31	5%	7	1%	9	2%	9	2%
2018	37	7%	7	1%	9	2%	9	2%
2019	42	8%	7	1%	9	2%	8	2%
2020	**46**	**9%**	**7**	**1%**	**9**	**2%**	**8**	**2%**

Note: £/year impacts in real 2010 prices.

Table 24b: Estimated Impact on average Non-Domestic Bills* (central scenario)

Impact on average non-domestic electricity bill	Do Nothing		Option 2 slow cost reduction		Option 2 central cost reduction		Option 2 fast cost reduction	
	£/yr	%	£/yr	%	£/yr	%	£/yr	%
2011	**4,500**	**0%**	**4,500**	**0%**	**4,500**	**0%**	**4,500**	**0%**
2012	13,000	1%	12,000	1%	12,000	1%	12,000	1%
2013	22,000	2%	16,000	1%	17,000	1%	18,000	1%
2014	35,000	2%	18,000	1%	20,000	1%	22,000	2%
2015	**53,000**	**4%**	**19,000**	**1%**	**23,000**	**2%**	**24,000**	**2%**
2016	73,000	5%	21,000	1%	25,000	2%	26,000	2%
2017	95,000	7%	22,000	2%	27,000	2%	27,000	2%
2018	120,000	8%	22,000	2%	28,000	2%	27,000	2%
2019	140,000	9%	23,000	2%	29,000	2%	27,000	2%
2020	**150,000**	**10%**	**24,000**	**2%**	**30,000**	**2%**	**27,000**	**2%**

*Typical Non-domestic user is assumed to be consuming 11,000MWh before efficiency savings in each year to 2020. Note: £/year impacts in real 2010 prices, rounded to nearest £1,000.

Economic Impacts

101. The Feed in Tariffs scheme has created business and job opportunities in green sectors of the economy (although the impact on net jobs across the economy is unclear). Estimates of the scale of this impact in the future are uncertain because they depend on factors such as how many installations will come forward, installation times and how many associated supply chain jobs are created. In addition, there is a range of methodologies that can and are being used to provide an indication of current solar PV jobs, which lead to various different estimates of jobs. For example, some estimates count any people doing any solar related tasks irrespective of whether this is the main part of their jobs, whilst others use different assumptions on the extent and depth of supply chain activities included.

102. The methodology adopted by DECC is set out in detail at Annex B. This methodology converts the length of time associated with different solar PV tasks to a full-time equivalent basis (FTE). The resulting estimates from this methodology for the tariff option 2 above are shown below.

103. As explained in paragraph 74, updated modelling assumptions have led to higher estimates of uptake in the near term, with a greater proportion of small scale generation in the overall assumption – leading to a higher central estimate of the number of installations in the short term. Table 25 below gives the estimated range of new installations over the next 3 years, with associated estimates of associated jobs. The lower range of installations is based on the low cost reduction assumption, and the higher range is based on the higher cost reduction assumptions, as set out above. To estimate the range of FTE jobs, we have applying our low estimate of FTE jobs per solar PV installation to the low estimate of installations. The high end of the range applies our high FTE jobs per installation estimate to the high uptake scenario.

Table 25: Estimated FTE jobs associated with solar PV for new installations projected between 2012/13 and 2014/15 under Option 2

	2012/13	2013/14	2014/15	Total 2012-2014
New installations between 2012-2014	140,000 - 250,000	170,000 - 340,000	170,000 - 330,000	480,000 - 910,000
FTE jobs for all installations between 2012-2014	10,000 - 20,000	10,000 - 30,000	10,000 - 30,000	30,000 - 70,000

Micro business exemption

104. Feed in tariffs provide subsidy for small scale low carbon electricity generation, and therefore do not count as regulation. The micro-business exemption does not apply.

Annex A - Assessment of PV subsidy costs against Budgets

The table below shows the DECC budget for all FIT technologies in nominal undiscounted terms:

Table 26: FITs budget

Costs to consumers, £m, nominal undiscounted	2011/12	2012/13	2013/14	2014/15	Total
FITs budget[20]	94	196	328	446	1064

Cost projections against the FITs budget

The FITs budget is presented in nominal, undiscounted terms, and is for all eligible technologies, not just for solar PV. Therefore, we have included estimates for non-PV technologies in the tables below in order to be able to compare against the above table. Estimates for non-PV technologies are taken from the non-PV draft Phase 2 February IA.

Option 1: Do Nothing

Table 27: Do Nothing costs to consumers versus FITs budget, central scenario

Costs to consumers, £m, nominal undiscounted, Do Nothing	2011/12	2012/13	2013/14	2014/15	Total
FITs budget	90	200	330	450	1,060
Do Nothing costs, central					
PV committed to end March 2012	140	420	430	440	1,420
PV additional spend from April 2012	0	80	360	870	1,300
PV total	**140**	**490**	**790**	**1,300**	**2,720**
Non-PV committed to April 2012	30	40	40	40	150
Non-PV additional	0	10	30	60	110
Non-PV total	30	50	80	100	260
Total 'Do nothing' costs	170	540	870	1,400	2,980
Surplus (+) or Deficit (-) against FITs budget	-80	-340	-540	-950	-1,920

[20] Note this was adjusted from the original published figures to take account of small scale installations that are more likely to come forward under FITs than the RO

Option 2

Table 28: Costs to consumers versus FITs budget for Option 2.

Costs to consumers, £m, nominal undiscounted, Option 2	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**Total**
FITs budget	90	200	330	450	1,060
PV committed to end March 2012	140	420	430	440	1,420
PV additional spend from April 2012	0	40	140	270	450
PV total	**140**	**460**	**570**	**710**	**1,870**
Non-PV committed to April 2012	30	40	40	40	150
Non-PV additional	0	10	30	60	110
Non-PV total	30	50	80	100	260
Total	170	510	650	810	2,130
Surplus (+) or Deficit (-) against FITs budget	-80	-310	-320	-360	-1,070

Annex B - Methodology in estimating job numbers associated with solar PV installations

It is difficult to accurately estimate, and forecast, numbers of jobs associated with any single technology or sector, such as Solar PV. However, there are a range of methodologies that can, and are, being used to provide an indication, although these inevitably lead to a range of estimates being calculated.

The key differences between the numbers quoted by DECC and other estimates lie within the breadth of the definition and the extent of the depth of the supply chain activities covered, as well as the methodology used.

DECC Estimates

DECC estimates are based on the number of solar PV installations projected in a given period and applying estimates of the time taken for various tasks associated with those installations from industry and independent consultants. They are then converted to a full-time equivalent (FTE) basis. Other estimates such as quoted by BIS have been commissioned from independent consultants, K-Matrix.[21] and those from industry sources, measure employment through all aspects of the supply chain, and is likely to cover a significantly wider range of tasks than those in the DECC estimates. They also estimate people in jobs as reported by the companies, who may have a mixture of full and part-time jobs, and would therefore give a higher estimate than DECC.

Are these gross or net jobs?

These are gross estimates expected to result from FITs incentivising take-up of solar. We also do not take account of potential jobs lost elsewhere in the economy due to substitution of solar power for other forms of power. Because we apply jobs estimates to the projected number of installations, the jobs relate to those installations over a given period of time.

Are they new jobs?

We can't be sure these are new jobs, as a residual amount of uptake could be expected without FITs, particularly as costs come down. Also, these jobs could be undertaken by people already working in the sector, and either reflect that they now are in work longer than they would have been without FITS or, if they are working part-time on solar, it could reflect a greater proportion of their time now spent on FITs.

How certain are they?

The jobs estimates are subject to a great deal of uncertainty. They use estimates from industry on the number of person days needed to install and maintain PV installations, then in some cases adding in jobs through the rest of the supply chain. They are then applied to the trajectory of new installations we expect in a given period. This is subject to a lot of uncertainty because of: uncertainty over take-up and how individuals will respond to the new tariff levels; the impact of the energy efficiency requirement, and how future costs will develop in the future.

[21] http://www.bis.gov.uk/policies/business-sectors/low-carbon-business-opportunities/market-intelligence/market-data

How are the estimates calculated?

The first step is to estimate the number of installations likely to come forward. The consultation document for this IA sets out 3 deployment scenarios based on slow, central and fast cost reduction. The range for new installations each year is set out in Table 30 below based on the slow and fast cost reduction scenarios.

We then apply an estimate of the number of man-days to complete an installation. These estimates are based on discussions with industry and solar representatives, although there could be higher or lower estimates depending on which source is used. We then add estimates of related tasks associated with these installations – for example maintenance, administration, project management, finance etc and, because these are uncertain, a range is used. We only have estimates with respect to domestic installations – larger installations will take longer but we have no evidence to base an estimate of these, therefore we have applied the estimates below across all scales.

We might expect that over time, that industry would learn from doing and improve the time involved in these installations. However, we do not have a good basis for estimating this potential improvement in productivity so our man-day estimates are assumed to be constant.

The table below sets out the steps involved:

Table 29: Range of estimates for jobs per PV installation

	Low	High
Installer days per installation	3	4
Maintenance and Indirect supply chain jobs per installation	12.5	13.4
Convert to FTE: divide by 226	226 working days per year	
FTE jobs/installation	0.07	0.08

Applying this range of 0.07 to 0.08 FTE to our estimate of installations gives the following range of estimates of FTE jobs from the scenarios set out above.

Table 30: Estimated FTE jobs associated with solar PV for new installations projected between 2012/13 and 2014/15.

	2012/13	2013/14	2014/15	Total 2012-2014
New installations between 2012-2014	140,000 - 250,000	170,000 - 340,000	170,000 - 330,000	480,000 - 910,000
FTE jobs for all installations between 2012-2014	10,000 - 20,000	10,000 - 30,000	10,000 - 30,000	30,000 - 70,000

Annex C – Tariff and ROI methodology

Changes to ROI methodology

There have been some minor changes to the way Return on Investment (ROI) is calculated in the FITs model since analysis carried out for the previous FITs IAs. ROI analysis is used to inform tariff setting and as part of Solar PV deployment modelling.

- **Export value.** Previously, all solar PV investors were assumed to receive the export tariff for electricity generated but not used on site. Larger scale investors (>250kW) are now assumed to be able to sell electricity to the grid for the export tariff + 0.5p/kWh.

- **Post FITs revenue.** Investors are assumed to continue benefiting from bill savings and export payments for generated electricity after they stop receiving generation tariffs for the remainder of the assumed Solar PV technology lifetime (35 years). It was previously assumed that during this period, investors would be able to sell electricity at the wholesale price. This approach appears to be inconsistent and so investors are now assumed to be able to sell electricity at the export tariff (or assumed export value for that band). This change reduces estimated ROIs by around 0.2%.

Calculation detail

Tariff calculations are based on a 'reference installation' with a defined set of characteristics (see Table 31 below for assumed characteristics for sub-4kW installation).

In order to determine the generation tariff level required to deliver a particular rate of return on capital for solar PV, the following information is required to estimate cost and revenue streams:-

- Revenue streams:
  - Generation tariff income
  - Income from exported electricity
  - Bill savings (from avoided electricity imports)
- Cost streams:
  - Capital cost (CapEx)
  - Operating cost (OpEx)

Rate of return calculation – detail

The methodology returns a required generation tariff for a specified rate of return on capital. The required generation tariff is the difference between levelized costs at the specified rate of return and the other revenue streams.

Step 1- calculate levelised generation costs

The levelised cost (the cost of the installation per unit of energy generated, ie p/kWh) of the installation is calculated as follows:-

Levelised cost =

[Annuitized CapEx + Annual OpEx]

÷ Annual kWh generation

x 100 (to convert this result from £/kWh into p/kWh)

Capital expenditure is a one off payment in the first year. By annuitizing this expenditure, the costs are spread over the lifetime of the installation. This is done using the PMT function in excel, using the specified rate of return, over the expected life of the technology.

Opex covers inverter replacement every 15 years, maintenance, labour and any running costs and is assumed to be constant over time. There are no other elements of costs.

To deliver the target return over the tariff life, the cost over the full technology life is squeezed into the tariff life period (see example calculation below for details).

Finally, dividing through by the system's annual generation then provides the levelised cost in £/kWh over the tariff lifetime. Multiplying through by 100 converts this into p/kWh.

Step 2- calculate revenues

The revenue stream from all sources is calculated as:

levelized revenue stream =

[% onsite use x retail electricity price over tariff life]

+ [% export to grid x export tariff over tariff life]

+ [annual post-tariff lifetime revenue]

The annuitized post-tariff lifetime revenue is the annual stream of bill savings and export payments between the end of the tariff life and the end of the technology life. This is assumed to accrue over the tariff lifetime. The annuitized revenue stream is divided by total annual electricity generated to derive revenue per KWh electricity produced.

Step 3 calculate generation tariff

The required generation tariff is the difference between the levelised cost over the tariff lifetime and the levelized revenue stream over the tariff lifetime. This ensures that levelised costs equal levelised revenues, where costs include a return on capital.

Generation tariff = Levelized cost – levelized revenue stream

Example <4kW Solar PV

NB this methodology shows how to calculate a generation tariff given a specified ROI. In practice, tariffs are now set independently of (but with consideration to) ROIs, and so it is necessary to calculate an ROI given a specified tariff. This is easily achievable by setting up the calculation below in Excel and then using goal seek to find the ROI that gives the specified tariff.

Table 31: assumptions / data sources for calculating generation tariff for a <4kW Solar PV installation in August 2012

Metric	Assumption	Source
Reference installation size	2.6kW	CEPA/PB (October 2011)
Capital cost (£/kW), £2010 prices.	A fixed £1,197, then £1,810/kW	PB (May2012). This value includes some part year cost reduction effects.
Annual operating cost (£2010)	£59, fixed	PB (May 2012). This value includes some part year learning effects.
Load factor	850kWh/kW/y	CEPA/PB (October 2011)
Technology lifetime	35 years	CEPA/PB (October 2011)
Assumed use	50% onsite, 50% export	CEPA/PB (October 2011)
Export tariff (£2010 value)	4.1p/kWh in 2011/12	This is 4.5p/kWh in £2010 prices.
Retail electricity price	15.4p/kWh (average for 2010-2020, 2010 prices)	DECC Energy and Emissions projections (see http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx)
Annual post FITs revenue – bill savings and export	£216/y	This assumes 50% of energy is used on site leading to bill savings of £170 at the 2012 residential electricity price (50% x 2,209kWh x £0.154) plus 50% of energy exported to grid sold for export value worth £45 (50% x 2,209kWh x £0.041). Electricity price estimates from DECC Energy and Emissions projections.
Projected RPI between end 2010 and August 2012	6.0% over 2 year period	OBR projections

A 2.6k system generates 2,209kWh per year, has a capital cost of £5,904 and an annual operating cost of £59 (all values in 2010 prices). The system lasts for 35 years, the tariffs last for 20 years. Calculations may not turn out with exact figures due to rounding of input variables. The chosen target ROI is 6.3%.

Step 1

Levelised cost =

[-PMT(0.063, 35, £5,904) + £59] x [PV(0.063,35,1) /PV(0.063,20,1)]

÷ 2,209 = £0.273/kWh

-> to convert this result from £/kWh into p/kWh, multiply by 100

= approx 27.3p/kWh

Step 2

Levelized post tariff revenue =

[£216 x (PV(0.063,35,1) – PV(0.063,20,1))/PV(0.063,20,1)] ÷ 2,209

= £0.024/kWh

-> to convert this result from £/kWh into p/kWh, multiply by 100

= approx 2.4p/kWh

Required generation tariff =

[27.3 – (0.5 x 15.4) – (0.5 x 4.1) – (2.4)]

= approx 15.1p/kWh

This value is in end 2010 prices. It is inflated to August 2012 prices by multiplying it by 1.06 to give the FIT generation tariff of **16.0p/kWh.**

Annex E – Tariffs and ROIs under each cost reduction scenario

This section presents anticipated tariffs and estimated ROIs for each option for each cost reduction scenario. Tariffs are expected to degress at different rates depending on speed at which installations costs fall. ROI's will increase as installation costs fall. Therefore, there is no direct relationship between the tariffs and ROI's under one scenario and another.

Tables 32-37: Tariffs and ROIs under various cost reduction scenarios

Table 32

Option 2 - Tariffs and ROI, Slow cost reduction		**Aug-2012**	**Feb-2013**	**Feb-2014**	**Feb-2015**
Tariffs, nominal, p/kWh	<4kW retrofit	16.00	15.44	13.87	12.03
	4 - 10kW retrofit	14.50	13.99	12.57	10.90
	10 - 50kW retrofit	13.50	13.50	12.57	10.90
	50-150kW retrofit	11.50	11.50	10.71	10.33
	150-250kW retrofit	11.00	11.00	10.24	9.88
	250-5000kW retrofit	7.10	7.10	6.61	6.38
	Stand alone	7.10	7.10	6.61	6.38
ROI	<4kW retrofit	6.1%	5.7%	5.5%	5.0%
	4 - 10kW retrofit	6.9%	6.5%	6.4%	5.9%
	10 - 50kW retrofit	6.8%	6.7%	6.8%	6.1%
	50-150kW retrofit	6.5%	6.4%	6.5%	6.5%
	150-250kW retrofit	7.1%	7.0%	7.1%	7.1%
	250-5000kW retrofit	7.7%	7.6%	7.9%	8.0%
	Stand alone	4.4%	4.3%	4.2%	4.1%

Table 33

Option 2 - Tariffs and ROI, Central cost reduction		**Aug-2012**	**Feb-2013**	**Feb-2014**	**Feb-2015**
Tariffs, nominal, p/kWh	<4kW retrofit	16.00	14.90	12.92	10.41
	4 - 10kW retrofit	14.50	13.50	11.71	9.43
	10 - 50kW retrofit	13.50	13.50	11.71	9.43
	50-150kW retrofit	11.50	11.50	10.71	9.29
	150-250kW retrofit	11.00	11.00	10.24	8.88
	250-5000kW retrofit	7.00	7.10	6.61	5.73
	Stand alone	7.10	7.10	6.61	5.73
ROI	<4kW retrofit	6.3%	6.3%	6.7%	6.2%
	4 - 10kW retrofit	7.2%	7.3%	7.9%	7.5%
	10 - 50kW retrofit	7.2%	7.8%	8.3%	7.6%
	50-150kW retrofit	6.8%	7.4%	8.5%	8.3%
	150-250kW retrofit	7.4%	8.0%	9.2%	8.9%
	250-5000kW retrofit	7.9%	8.6%	10.0%	10.0%
	Stand alone	4.6%	5.1%	5.8%	5.4%

Table 34

Option 2 - Tariffs and ROI, Fast cost reduction		Aug-2012	Feb-2013	Feb-2014	Feb-2015
Tariffs, nominal, p/kWh	<4kW retrofit	16.00	13.28	10.69	5.30
	4 - 10kW retrofit	14.50	12.03	9.69	4.80
	10 - 50kW retrofit	13.50	12.03	9.69	4.80
	50-150kW retrofit	11.50	11.50	9.61	4.44
	150-250kW retrofit	11.00	11.00	9.19	4.44
	250-5000kW retrofit	7.10	7.10	5.93	3.51
	Stand alone	7.10	7.10	5.93	3.51
ROI	<4kW retrofit	6.7%	6.6%	7.8%	6.1%
	4 - 10kW retrofit	7.6%	7.7%	9.5%	7.8%
	10 - 50kW retrofit	7.6%	8.1%	9.9%	7.6%
	50-150kW retrofit	7.2%	8.6%	10.7%	8.0%
	150-250kW retrofit	7.8%	9.3%	11.5%	8.8%
	250-5000kW retrofit	8.4%	9.9%	12.6%	11.5%
	Stand alone	4.9%	6.0%	7.4%	5.8%

Table 35

Tariffs and ROI, Do nothing, Slow cost reduction		Aug-2012	Feb-2013	Feb-2014	Feb-2015
Tariffs, nominal, p/kWh	<4kW retrofit	21.00	21.00	22.05	22.70
	4 - 10kW retrofit	16.80	16.80	17.64	18.16
	10 - 50kW retrofit	15.20	15.20	15.96	16.43
	50-150kW retrofit	12.90	12.90	13.54	13.94
	150-250kW retrofit	12.90	12.90	13.54	13.94
	250-5000kW retrofit	8.90	8.90	9.34	9.62
	Stand alone	8.90	8.90	9.34	9.62
ROI	<4kW retrofit	8.5%	8.4%	9.2%	9.7%
	4 - 10kW retrofit	8.3%	8.1%	8.9%	9.4%
	10 - 50kW retrofit	8.1%	7.9%	8.8%	9.2%
	50-150kW retrofit	7.5%	7.4%	8.3%	8.6%
	150-250kW retrofit	8.5%	8.3%	9.2%	9.6%
	250-5000kW retrofit	9.0%	8.9%	9.9%	10.3%
	Stand alone	5.4%	5.2%	5.8%	6.1%

Table 36

Tariffs and ROI, Do nothing, Central cost reduction		Aug-2012	Feb-2013	Feb-2014	Feb-2015
Tariffs, nominal, p/kWh	<4kW retrofit	21.00	21.00	22.05	22.70
	4 - 10kW retrofit	16.80	16.80	17.64	18.16
	10 - 50kW retrofit	15.20	15.20	15.96	16.43
	50-150kW retrofit	12.90	12.90	13.54	13.94
	150-250kW retrofit	12.90	12.90	13.54	13.94
	250-5000kW retrofit	8.90	8.90	9.34	9.62
	Stand alone	8.90	8.90	9.34	9.62
ROI	<4kW retrofit	8.9%	9.3%	11.1%	12.2%
	4 - 10kW retrofit	8.6%	9.2%	11.1%	12.2%
	10 - 50kW retrofit	8.4%	9.0%	10.9%	12.0%
	50-150kW retrofit	7.9%	8.4%	10.3%	11.3%
	150-250kW retrofit	8.8%	9.4%	11.4%	12.5%
	250-5000kW retrofit	9.4%	10.0%	12.2%	13.3%
	Stand alone	5.6%	6.1%	7.5%	8.3%

Table 37

Tariffs and ROI, Do nothing, High cost reduction		Aug-2012	Feb-2013	Feb-2014	Feb-2015
Tariffs, nominal, p/kWh	<4kW retrofit	21.00	21.00	22.05	22.70
	4 - 10kW retrofit	16.80	16.80	17.64	18.16
	10 - 50kW retrofit	15.20	15.20	15.96	16.43
	50-150kW retrofit	12.90	12.90	13.54	13.94
	150-250kW retrofit	12.90	12.90	13.54	13.94
	250-5000kW retrofit	8.90	8.90	9.34	9.62
	Stand alone	8.90	8.90	9.34	9.62
ROI	<4kW retrofit	9.2%	10.5%	14.1%	16.1%
	4 - 10kW retrofit	9.0%	10.4%	14.5%	16.7%
	10 - 50kW retrofit	8.8%	10.2%	14.4%	16.4%
	50-150kW retrofit	8.2%	9.6%	13.6%	15.6%
	150-250kW retrofit	9.2%	10.7%	15.0%	17.1%
	250-5000kW retrofit	9.8%	11.3%	15.8%	18.1%
	Stand alone	6.0%	7.1%	10.2%	11.7%