CAMBRIDGE MODELLING

UK Solar PV Industry:

Implications of the Planned Feed-in Tariff Reductions

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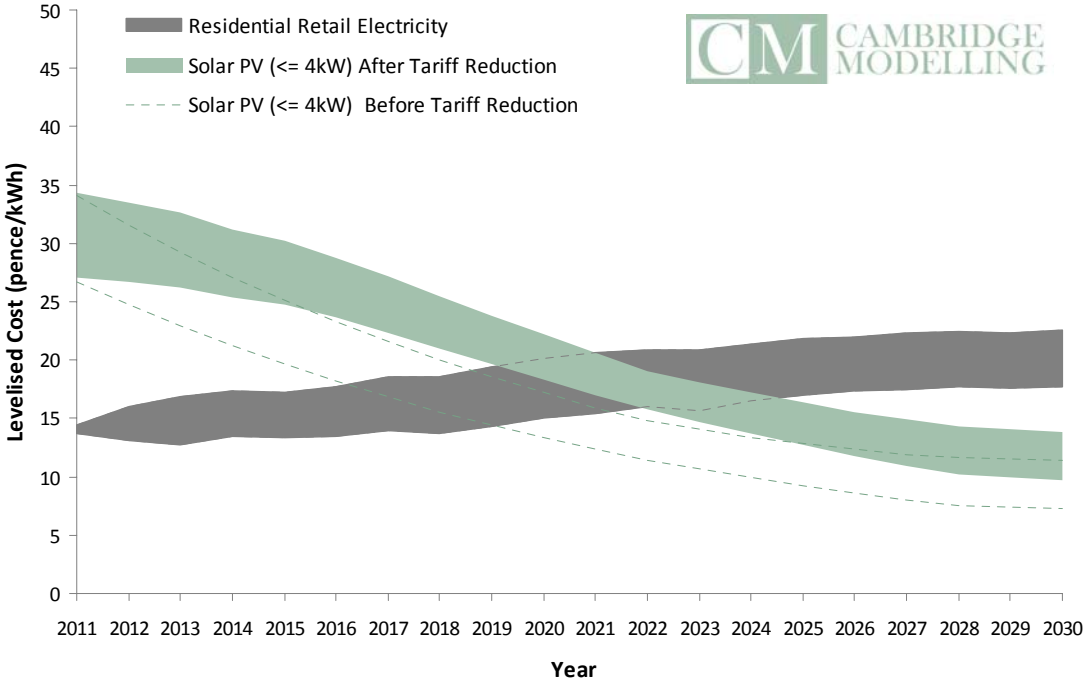
Executive Summary

- Under the current level of solar feed-in tariffs (FITs), small solar photovoltaic (PV) installations of 4 kW or less are set to attain grid parity with residential electricity prices by about 2019. The reductions in solar PV tariffs recommended by the recent Department of Energy and Climate Change (DECC) FITs scheme consultation[1] are expected to delay grid parity and extend the need for feed-in tariff support of small solar PV installations by approximately 3 years.



Source: DECC Energy & Emissions Projections October 2011, Cambridge Modelling Analysis

- The impact of the planned FITs changes on grid parity timing and the development of UK solar PV industry efficiencies are not currently considered in the DECC consultation report. Consequently, important areas of savings for UK electricity consumers under the existing tariffs (more than £57 million in 2020 alone) have been overlooked. This briefing recommends that the implications of these and other national learning phenomena be integrated into the Comprehensive Review of the FITs scheme.
- Given the short-term price volatility of solar PV modules, it is important to base capital cost forecasts for solar PV on long-term module price trends. This briefing recommends caution in response to indications that the DECC consultation report is placing excessive emphasis on recent strong downward fluctuations in the price of solar PV modules.
- The combined assumptions of optimistic capital cost forecasts and large reductions in the rate of return on investment (from about 10.6% to 4.45% for installations of 4 kW or less) in the DECC consultation report leaves the solar PV industry with no margin for module price fluctuations in a traditionally volatile market. This briefing recommends a more conservative and sustainable approach.

Introduction

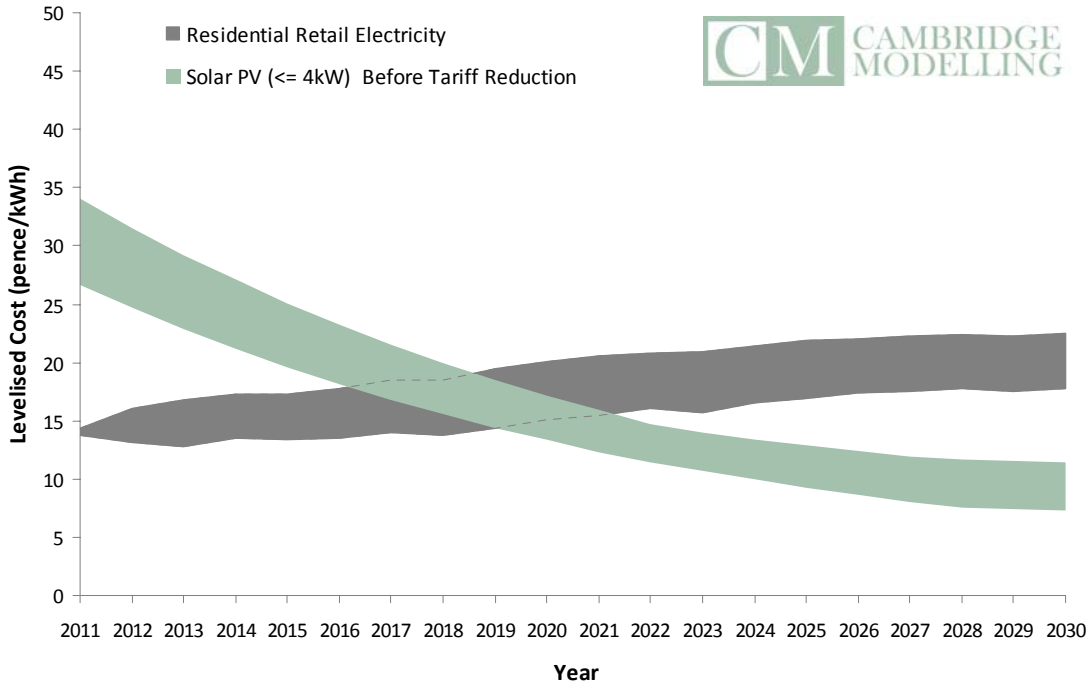
This briefing examines the impact of the UK government's planned reduction in feed-in tariffs (FITs) for solar photovoltaic (PV) installations up to 250 kW, with a primary focus on installations of 4 kW or less. The analysis described here explores key considerations not covered in the Department of Energy and Climate Change (DECC) consultation[1] on the Comprehensive Review Phase 1 (on which the reductions are based), that are pertinent to grid parity in the UK solar PV industry, the price of retail electricity and national commitments under the Renewable Energy Directive. Modelled forecasts for the generation costs of small solar PV installations (4 kW or less) are also presented here in the context of the FITs reductions. The specific tariff changes to which this briefing relates are summarised below in Table 1.

Table 1: Generation tariffs for solar PV before and after the planned Comprehensive Review Phase 1 changes[1].

Installation Band	Current Tariff (p/kWh)	Proposed Tariff (p/kWh)
4 kW or less (new build)	37.8	21.0
4 kW or less (retrofit)	43.3	21.0
>4 – 10 kW	37.8	16.8
>10 – 50 kW	32.9	15.2
>50 – 100 kW	19	12.9
>100 – 150 kW	19	12.9
>150 – 250 kW	15	12.9

Grid Parity for Solar PV in the UK

The planned changes to solar PV FITs under Phase 1 of the Comprehensive Review have significant implications for the long-term evolution of solar PV costs in the UK and the attainment of grid parity with retail electricity prices. The consultation on the Comprehensive Review estimates that the current round of changes to solar PV FITs will reduce UK uptake of solar PV by 83% (from 12,300 GWh to 2,100 GWh) by 2020[1]. Modelling analysis by Cambridge Modelling indicates that without the planned changes to the FITs scheme, UK solar PV installations in the 4 kW or less band are most likely to reach grid parity with residential electricity prices in approximately 2019, though possibly as early as 2016 (see Figure 1).



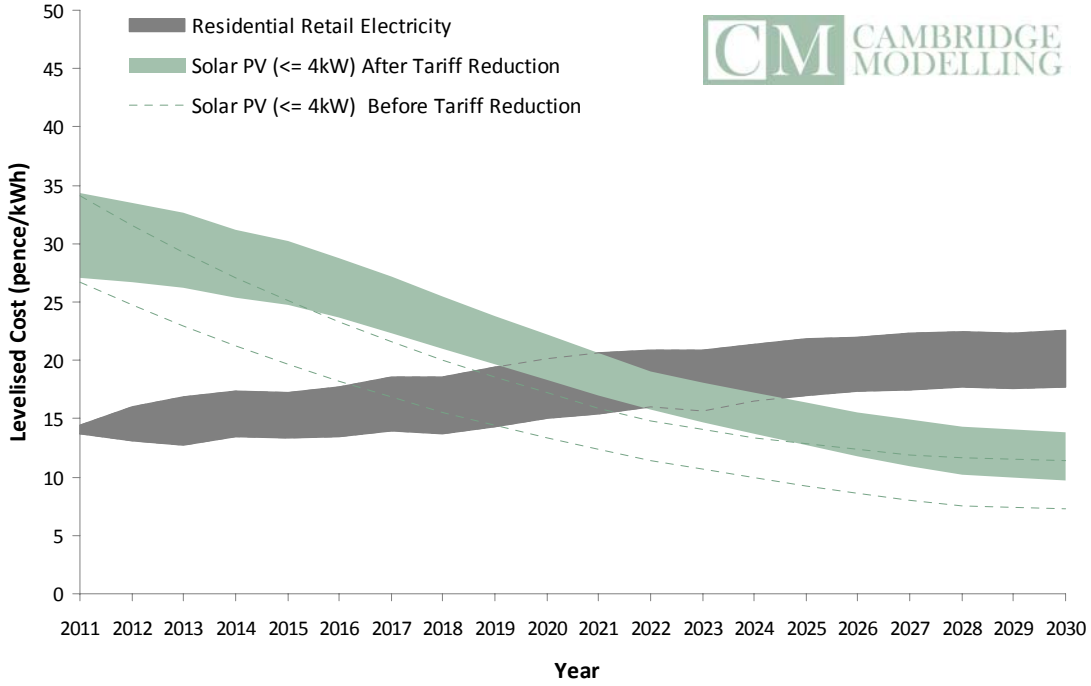
Source: DECC Energy & Emissions Projections October 2011, Cambridge Modelling Analysis

Figure 1: Forecast cost of solar PV for installations in the 4 kW or less band before the planned reduction in FITs compared to the DECC forecasts for residential electricity prices[2].

Achieving grid parity in 2019 would mean that by 2020 solar PV installations in the 4 kW or less band would not require FITs support. Instead, they would offer a 3.5 p/kWh saving relative to residential electricity prices. When this price advantage is applied across the total installations expected in 2020 under the FITs scheme prior to the Comprehensive Review changes, this price advantage equates to an approximate saving of £57 million in 2020 –equivalent to about £1.90 off the annual energy bill of each household[3] in the UK in 2020. The saving would increase each year as retail electricity prices continue to increase and would be further compounded for new solar PV installations which benefit from additional reductions in installation costs.

The planned changes to solar PV FITs and the resulting reduction in UK solar PV uptake would have little impact on the global adoption of solar PV, ongoing global PV technology learning and the reduction in the cost of solar PV modules. However, the magnitude of the decrease in national solar PV uptake with the new FITs would have a considerable impact on learning within the UK solar PV industry in relation to installation costs, commercial efficiencies and labour force development (see Appendix A for further information on industry learning and learning rates). Assuming module and inverter costs make up approximately 50% of solar PV installation costs[4], the proposed reduction in solar PV FITs under the Comprehensive Review is estimated to delay solar PV

grid parity with UK residential electricity prices by approximately 3 years (see Figure 2).



Source: DECC Energy & Emissions Projections October 2011, Cambridge Modelling Analysis

Figure 2: Forecast cost of solar PV for installations in the 4 kW or less band after the FITs reductions compared to the DECC forecasts for residential electricity prices[2]. The forecast for solar PV costs prior to the FITs scheme changes (from Figure 1) is also shown here as a dashed outline for comparison.

The 3 year delay in grid parity under the planned FITs reductions implies that solar PV would most likely still require tariff support in 2020 under the changed scheme. This means that in 2020 the changes to the solar PV FITs scheme would cost UK electricity consumers £57 million in addition to the cost of the FITs support required for new installations in 2020. In context, this amount is considerably less than the cost reductions the scheme changes are predicted to achieve via reduced tariff commitments leading up to 2020. However, the savings associated with advanced grid parity and national learning phenomena should be included in any cost benefit analysis of FITs scheme changes.

Unfortunately, the early attainment of grid parity and other savings associated with learning in the domestic solar PV industry were not considered in the cost benefit analysis used by the consultation on Phase 1 of the Comprehensive Review. It is recommended that accounting in the Comprehensive Review be corrected to include the cost savings associated with the domestic component of learning behaviour for solar PV.

Solar PV Cost Reduction Trends

Large fluctuations in the price of poly silicon in the past year (by more than 50%)[5] have impacted significantly on solar PV module costs. In recent months, this trend has been favourable with technical improvements and reduced global demand leading to a general reduction in module prices. However, the sensitivity of poly silicon and PV module prices to market demand means that their contribution to recent large reductions in the cost of solar PV installations is subject to change. This has been illustrated in recent years where spikes in solar PV demand have caused temporary retardations in industry learning rates and significantly increased module costs[6].

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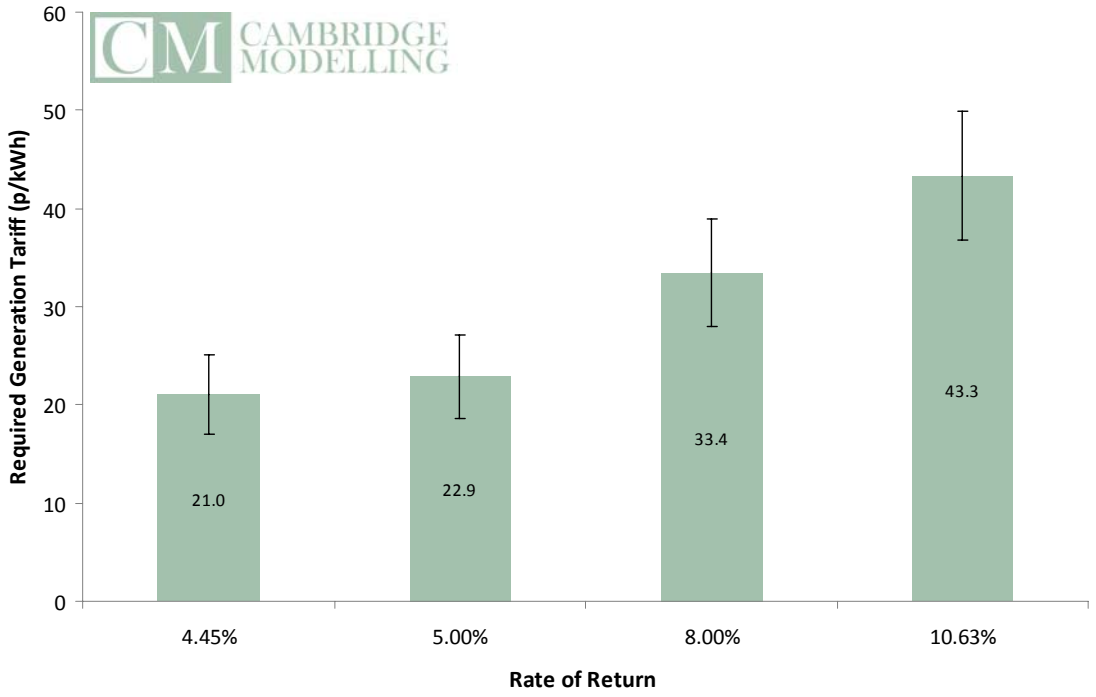
Therefore, a longer-term view of solar PV cost reduction trends is required to avoid aberrations produced by short-term fluctuations in global demand. The amount by which FITs are periodically reduced needs to be based on long-term trends (over a period of years) in solar PV installation costs to overcome short-term inconsistencies produced by temporary fluctuations in poly silicon and solar PV module prices. This recommendation is particularly relevant in the context of the consultation on the Comprehensive Review and is worthy of further consideration in this and later rounds of tariff reductions.

The Scale of Feed-in Tariff Reductions

Given the magnitude of recent reductions in the cost of solar PV installations[1,4], the real rates of return on installations were exceeding the 5–8% levels originally intended for the FITs scheme (with the specific target for solar PV being 5% due to its ease of deployment and low risk)[7]. In the case of retrofit installations in the 4 kW or less category, the current tariff would yield a rate of return of approximately 10.63% in 2012. Using the same assumptions[8] as the consultation on the Comprehensive Review Phase 1, the required FITs for various real rates of return on 4 kW or less installations in 2012 are shown below in Figure 3.



Source: DECC Feed-In Tariffs Comprehensive Review 2011, Cambridge Modelling Analysis

Figure 3: The generation tariff required for various target rates of return on solar PV installations of 4 kW or less in 2012.

The future installation capital costs on which the consultation to the Comprehensive Review based its rate of return estimates assume "continuing significant falls in prices for PV modules"[9]. Presuming the unbroken continuation of recent large downturns in solar PV module costs exposes these calculations to significant potential for error. Should demand spikes and volatility in the price of poly silicon cause the price of solar PV modules to temporarily increase (as they did last year and on numerous other occasions in recent times[5]) the capital expenditure assumptions used by the Comprehensive Review will significantly overestimate the rates of return available to generators and underestimate the amount of FITs required. Indeed, solar PV modules make up approximately 40% of the installed system cost[4] which means this risky assumption could propagate large errors through the rate of return and FITs estimates used by the Comprehensive Review.

With this in mind, the decision to push the target rate of return down to 4.45% for solar PV installations of 4 kW or less not only strays from the original target of the FITs scheme for solar PV installations (5% return), but also reduces the margin for error. The combination of optimistic capital expenditure assumptions with excessive reductions in the target rate of return leaves the solar PV industry with no margin for module price fluctuations in a traditionally volatile market.

Solar PV's Role in the Renewable Energy Directive

Solar PV plays a relatively minor role in the context of the European Renewable Energy Directive, which sets a target for the UK to achieve 15% of its total energy consumption from renewable sources. Solar PV generally accounts for less than 2% of 2020 renewable electricity generation in DECC forecasts[1,10] for meeting the UK's 2020 renewable energy obligations. However, solar PV is uniquely positioned to fill capacity shortfalls left by other underperforming renewable energy sources.

"the ability to rapidly deploy solar PV resources is constrained by the existing size of the industry and its confidence in the stability of the FITs system"

The DECC has an ambitious target of supplying 30% of electricity demand from renewable sources by 2020 as part of the UK's commitment to the European Renewable Energy Directive[10,11]. Wind energy is expected to make the largest contribution to the estimated 234 TWh renewable energy target for 2020 with offshore and onshore wind expected to supply 33–58 TWh and 24–32 TWh, respectively in 2020[12].

However, the deployment of wind has been hampered by supply chain bottle necks, problems obtaining consents, access to the grid and difficulty securing the financing levels required[13]. The ease of deployment and low risk of solar PV lends itself to rapidly ramping up installation volumes if necessary to cover any shortfall in capacity for wind energy or other key renewable energy sources. Within the constraints of solar PV industry growth rates, the ease of manipulating solar PV FITs represents a valuable lever for boosting UK renewable capacity. For example, by leaving the solar PV FITs scheme unchanged, the UK could achieve an estimated addition 10 TWh of solar PV generation by 2020 beyond the levels expected with the planned FITs reductions[1].

This highlights the importance of avoiding large and sudden changes to solar PV FITs and excessive disruption to the UK solar PV industry, since the ability to rapidly deploy solar PV resources is constrained by the existing size of the industry and its confidence in the stability of the FITs system. Reducing the real rate of return of 4 kW or less solar PV installations by more than half (from 10.63% to 4.45%) is certainly disruptive in this context. Furthermore, it is important that the development of solar PV in the UK is maintained at a steady rate, to avoid short term demand spikes, local price volatility and stranding of industry resources and labour.

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Appendix A: Learning Rates

The costs of new technologies generally decrease as their production volumes increase. This process is referred to as "learning" and is related to improvements in technology development, economies of scale, know-how and industry efficiencies. Therefore, the level of feed-in tariff support is designed to decrease as the disparity between the cost of the new technology and that of the status quo is gradually overcome.

The rate at which the cost of a given technology decreases as its production volumes increase is referred to as its "learning rate". The learning rate is defined as the percentage reduction in unit cost as production volume doubles. For solar PV, the global learning rate is relatively high, generally observed to be between 15% and 22%[14].

For technologies, such as solar PV, that contribute to the UK achieving its carbon budgets and renewable energy target, there is a necessity to subsidise the initially high costs of these technologies until they reach sufficient production volumes to be price competitive in their own right. This subsidy often takes the form of a feed-in tariff. Here the decrease in cost, and hence the amount of the feed-in tariff required, can be forecast using learning rates and other knowledge relating to industry growth dynamics.

Given the relatively immature status of the UK solar PV market compared to the global market, a large proportion of the learning behaviour in the UK market is determined by global factors such as solar PV module and inverter costs. The convergence of learning behaviour in the UK with that of more mature global solar PV markets is considered in all UK based learning simulation described in this briefing.

Appendix B: Modelling

All modelling reported in this briefing was conducted using Cambridge Modelling's Low Carbon Simulator, a Monte Carlo based scenario modelling system. Where possible, assumptions on the UK economy and solar PV costs and uptake were aligned with those used in the DECC consultation on the Comprehensive Review of FITs[1]. Global scenarios were modelled using the DECC globally traded carbon price forecasts[15] and assumed global emissions reductions of 80% by 2050 in keeping with the avoidance of a 2°C increase in average global temperatures.

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