

CeresPower



Fuel cell products for global energy markets

UK Government Feed-in Tariff (FIT) for Residential mCHP

Feb 2010

Feed-in Tariff – Purpose & Funding

- **UK Government announced a Feed-in Tariff (FIT) for small-scale low carbon generation**
 - Incentive for British households to invest in low carbon microgeneration technologies
 - Designed to accelerate market uptake of microgeneration products by reducing the payback periods and/or reducing the up-front price per unit
 - Part of “Clean Energy Cash Back” scheme - reflecting the consumer-facing nature of the incentive
 - Fuel cell microCHP (mCHP) fed by either natural gas or LPG qualifies for the FIT incentive
 - Mass deployment of mCHP supported by the FIT will help the UK meet its carbon and renewables targets for 2020 and beyond
- **FIT is not funded by government subsidy**
 - FIT is funded through a modest increase on all consumers’ electricity bills (i.e. a green tax) across Britain’s ~25 million homes
 - FIT scheme to be administered by energy regulator (Ofgem) and implemented with support from the electricity suppliers (e.g. British Gas and others)
 - Funds are collected by suppliers and then re-distributed to those households investing in qualifying microgeneration products like residential mCHP ($\leq 2\text{kW}$)

The FIT scheme is “...designed to bring about a significant increase in the amount of locally produced green energy, as a contribution to the wider shift of the energy mix to low carbon.” FIT: Government’s Response to the Summer 2009 Consultation, DECC 1 Feb 2010

Feed-in Tariff – Structure

- **FITs are designed to encourage on-site electricity generation and on-site consumption**

- A significant ‘generation tariff’ paid for all electricity generated in the home; plus
- A modest ‘export tariff’ paid for any electricity generated and exported to the grid
- Households retain the energy savings from electricity generated and not purchased from grid
- Total resulting value is greater for electricity generated and consumed on-site *rather than* exported to the grid (i.e. due to the retail electricity price >> ‘export tariff’ to the grid)

- **Timescales**

- FIT scheme will start in Great Britain in April 2010
- Review periods are scheduled to occur every 3 years (i.e. 2013, 2016, ...) as part of the Renewables Obligation (RO) review cycle to re-examine how well the incentive mechanism is working to stimulate market uptake of microgeneration products
- FIT levels for new installations after the first review point may be set using an annual ‘degression rate’ (to reflect cost-down curve for each technology) in order to modify uptake rates
- The FIT tariff level for mCHP is fixed until first review in 2013 or until 30,000 units installed (which ever is sooner) once a large enough data set for units in the field will have informed the FIT level going forward
- FIT tariff level for a given mCHP installation is guaranteed at that level for 10 years

“The guarantee of getting an income on top of saving on energy bills will be an incentive to householders and communities wanting to make the move to low carbon living.” Secretary of State for Energy and Climate Change, Ed Miliband, 1 Feb 2010

Predicted CHP Carbon Savings Independently Confirmed

- Independent confirmation by Oxera
 - Macro economic consultancy specialising in energy sector
 - Model of actual UK energy system including individual power plants (used by industry & Government)
- Oxera confirmed carbon savings potential based on
 - Ceres Power CHP product's target performance and operating characteristics
 - Predicted decarbonisation of centralised generation (incl. large-scale deployment of renewables and nuclear)
 - Likely response of central generation to mass deployment of micro CHP
 - Resultant likely CO₂ savings (taking into account current and projected 'merit order')
- Annual carbon savings of 1 to 1.5 tonnes p.a. up to 2020
 - Relative to high efficiency condensing boiler and grid-supplied electricity
 - Based on actual power plants displaced in the merit order
- Potential for significant additional benefits to UK energy system
 - Reduces peak demand and generation investment requirements
 - Reduces capex requirements for grid network



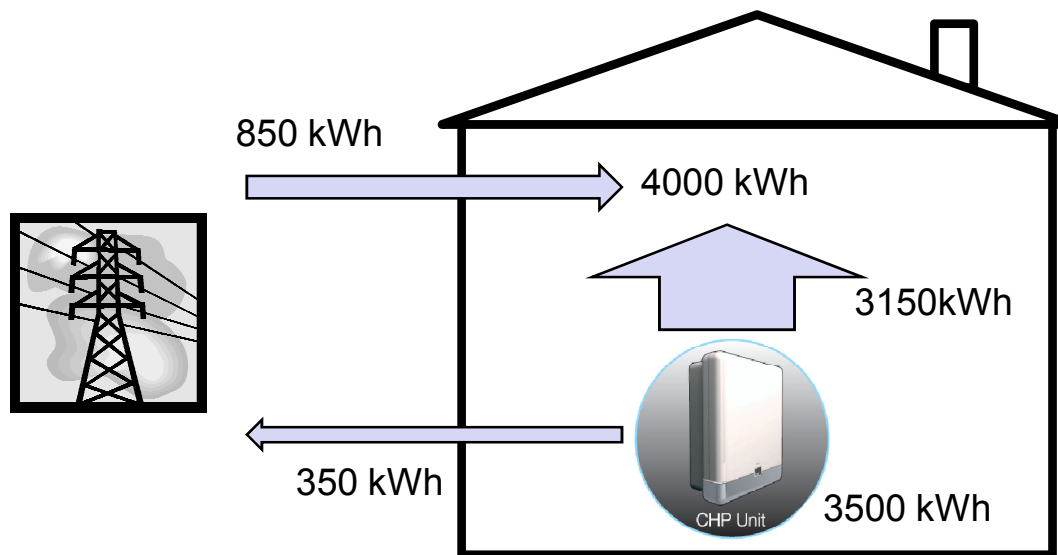
Predicted CHP Energy Savings Independently Confirmed

- Independent confirmation by Element Energy
 - Energy consultancy advising Government on low-carbon issues
 - Experts in energy use in buildings & techno-economic modelling
- Element Energy confirmed energy savings potential based on
 - Ceres Power CHP product's target performance, control strategy & operating characteristics
 - Measured energy demand in representative homes across UK housing stock
- Annual predicted energy bill cost savings of ~ 25%
 - Relative to high efficiency condensing boiler and grid-supplied electricity
 - Based on measured real home occupancy, actual energy demands, and usage patterns for mass market homes with occupancy of 2-3 persons
- Mass market potential uptake for residential mCHP in UK
 - Completed detailed analysis & segmentation of UK housing stock
 - Mass market potential demonstrated for a product with Ceres-type characteristics

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Worked Example of Flows of Energy and Payments

- Home consumes 4,000 kWh of electricity
- mCHP product generates 3,500 kWh of electricity in the home
 - 3,150 kWh is consumed within the house*
 - 350 kWh surplus is exported to the grid*
 - 850 kWh imported from the grid*
- Household receives cash value as follows
 - Generation FIT cash payment for 3,500 kWh of electricity generated by mCHP unit; plus
 - Export FIT cash payment for 350 kWh of electricity generated and exported; plus
 - Additional savings from avoided purchase of 3,150 kWh of electricity



* Assuming 90% of electricity produced is consumed on-site in the house and 10% is exported to the grid

Feed-in Tariff – Worked Example

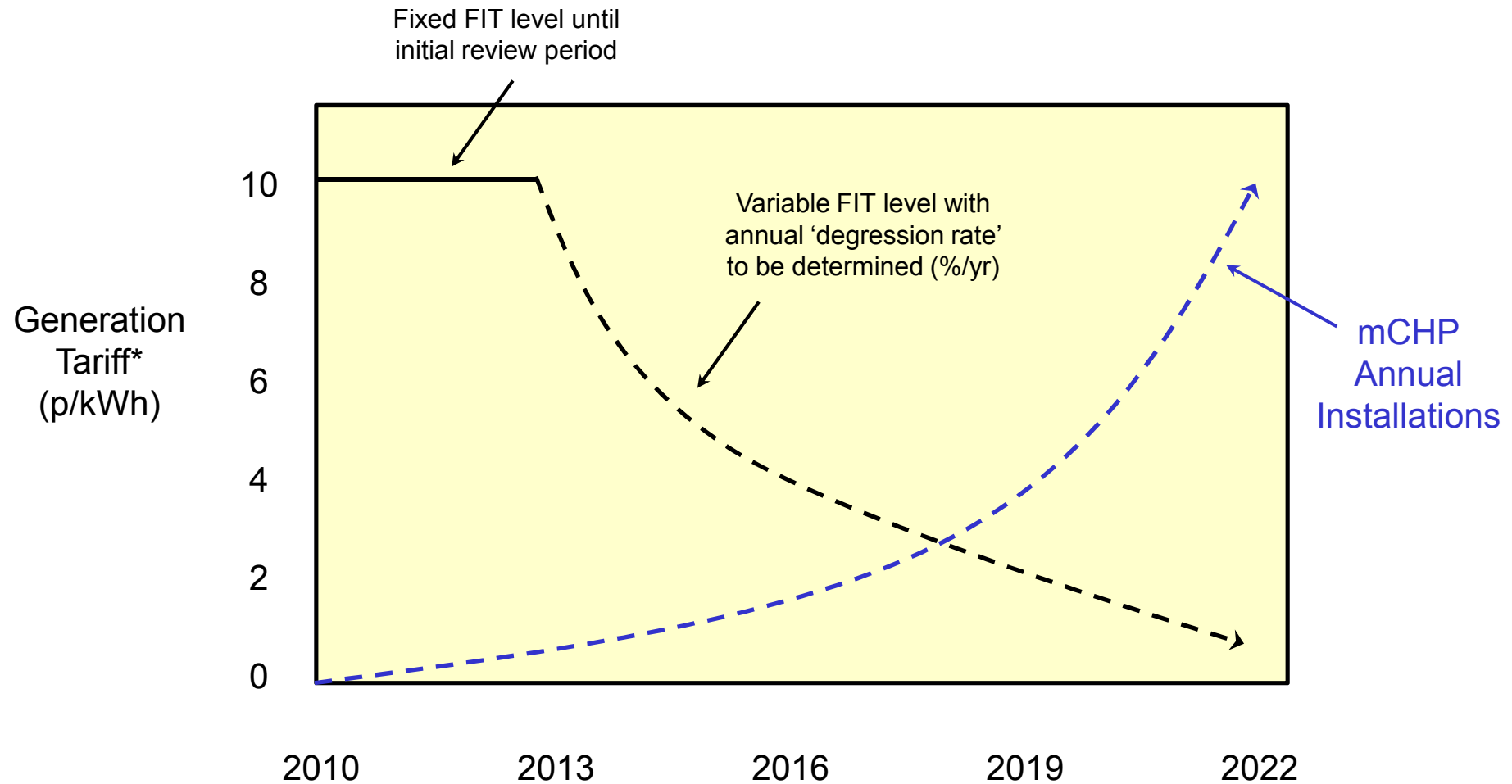
Annual electricity generated by mCHP unit [†] (kWh)		3500 kWh
% of mCHP unit electricity generation exported to the grid [‡]		10%
Generation Tariff (p/kWh on all electricity generated)		10 p/kWh
Export Tariff (p/kWh on electricity generated and exported)		3 p/kWh
Annual generation tariff payment to household	(i.e. 3500 kWh x 10 p/kWh)	£350.00 /yr
Annual export tariff payment to household	(i.e. 350 kWh x 3 p/kWh)	£10.50 /yr
Total annual value of FIT to household		£360.50 /yr
Equivalent capitalised value of FIT if paid up-front as lump sum (e.g. NPV at 10%)		£2,215

- The FIT payments add to the household's reduced energy bills from running the mCHP unit (i.e. ~25% of total annual energy bill of gas + electricity of around £1100) ~ **£275/yr**
- Total annual savings of installing a mCHP unit: energy savings + FIT ~ **£635/yr**

[†] Assumed total annual amount of electricity generated in a typical UK home based on Ceres Power's control system

[‡] Assumed proportion of electricity generated by the CHP unit that is exported to the grid and not used in the home

Feed-in Tariff Levels – Illustrative Time Evolution



** N.B. Once a given mCHP unit is installed, the 'generation tariff' level for that unit and/or household is then fixed for 10 years (it is possible that in years beyond the first review period, the FIT level for any new installations may decrease as economies of scale are realised, product costs are reduced and market uptake increases)*

Feed-in Tariff – Benefits

- **Significant boost for residential mCHP market**

- Increased annual savings on energy bills improves pay-back period on mCHP purchase price
- Possible capitalisation of feed-in tariff into an up-front lump sum (e.g. by an energy supplier or a bank) could reduce up-front premium of mCHP over a boiler
- Energy savings and FIT payments could be enhanced further through smart meter roll-out, enabling time-of-day electricity pricing
- FIT applies to mCHP products with an electrical generation capacity of up to 2kW (i.e. residential scale as opposed to industrial scale)

- **Benefits of accelerated residential CHP deployment to UK's energy system**

- Reduced carbon emissions from the household sector (currently the UK's largest emitter)
- More efficient use of energy resources like natural gas
- Reduced strain on the electricity grid, especially at peak times
- Controllable power output from mCHP units can enable greater uptake of intermittent renewables

Useful Links Related to FIT and mCHP

- <http://www.decc.gov.uk/>
- <http://www.chpa.co.uk/>
- <http://www.sbgi.org.uk/hhic>
- <http://www.micropower.co.uk/>
- <http://www.britishgas.co.uk/>



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