

Information paper – 30

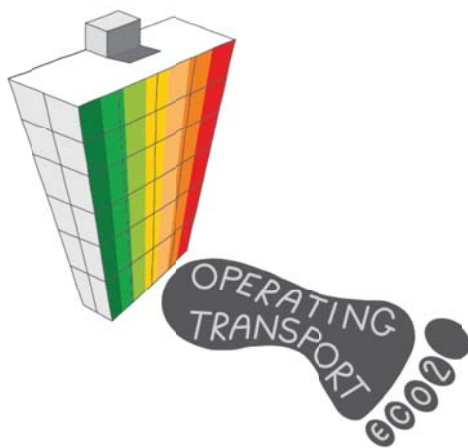
UK government incentives for renewables

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WHAT COLOUR is YOUR BUILDING?

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This information paper is one of a series of papers written during the preparation of the book **What Colour is Your Building?** (www.whatcolourisyourbuilding.com). The papers do not form part of the book and have not been peer reviewed. They provide further technical detail, analysis and information to support statements made in the book. All of the papers can be downloaded from www.wholecarbonfootprint.com.

UK government incentives for renewables

This information paper provides an overview of government incentives for renewable energy systems in the UK in July 2013, and how these would alter the financial benefits of the renewable energy systems described in Chapter 7 of the book.

1. TYPES OF INCENTIVES AND CHANGES OVER TIME

Electricity Feed-in Tariffs

To encourage the uptake of renewable electricity generation systems many governments have introduced feed-in tariffs (FiTs). These provide generous payments for each kWh of electricity generated, making renewables a financially valuable proposition to building or land owners with spare space (e.g. roofs and fields). Germany has had feed-in tariffs for many years and has built up a large photovoltaic (PV) industry as a result, despite it not being a particularly sunny country.

In the UK, feed-in tariffs were introduced in April 2010 and immediately spawned a new industry – businesses installed PV panels on a roof at no cost to the building owner who was provided the electricity generated for free while the installer received the feed-in tariff. Prior to the introduction of feed-in tariffs the financial payback for PV was between 40 to 60 years. When the initial tariff for households was 36 p/kWh the scheme cost around £600 for every tonne of CO₂ offset. In comparison the cost of carbon from various regulatory carbon trading / tax schemes applicable in the UK is between £5 to £12 per tonne.¹

After one year of operation the UK government announced a scaling back of the tariffs for 'large scale' PV, which meant any system over 50 kWe (approximately 375 m²). Subsequent announcements were made to cut the tariffs for all system sizes. According to Ofgem, 'more than 372 MW of domestic solar PV installations were registered since the government announced its original plans to slash the subsidy on 31 October 2011. That four month frenzy compares to just 262 MW installed in the 18 months stretching back to when the scheme began in April 2010.'

Large and sudden cuts in tariffs are not unusual. The New South Wales government in Australia introduced a similarly generous feed-in tariff scheme in January 2010. The tariff was suddenly reduced by two thirds just 10 months later due to the large uptake and the realisation that it would significantly increase energy costs to all other electricity consumers in the state.²

Whether generous feed-in tariffs are the right solution to drive carbon reduction in buildings is debatable – but introducing them, encouraging installers and suppliers to gear up for an increase in demand, and then suddenly changing the rules does not inspire confidence. Industry requires certainty before committing to investment in production, recruitment and training.

Table 1 shows the feed-in tariffs from 2010 to 2013.³ Higher, lower and medium rates were introduced for PV in August 2012. The higher rate prevails except where:

- The building does not have an EPC certificate showing its energy efficiency in bands A to D in which case the lower band of 6.85 p/kWh applies in July 2013.

- The system owner already has a total of 25 FIT-registered PV installations in which case the medium rate is payable (90% of the higher rate).

System	Capacity (kWe)	Typical Size (area / dia)	2010/11	2011/12	2012/13	Jul-2013	Tariff paid per tCO2 offset	
			p/kWh	p/kWh	p/kWh	p/kWh	2010/11	Jul-13
Photovoltaic	<4kW (existing)	26 m ²	45.4	21.0	16.0	14.9	£757	£248
	<4kW (new build)	26 m ²	39.6	21.0	16.0	14.9	£660	£248
	4 to 10 kW	65 m ²	39.6	16.8	14.5	13.5	£660	£225
	10 to 50 kW	323 m ²	34.5	15.2	13.5	12.6	£575	£210
	50 to 100 kW	645 m ²	34.5	19.9	11.5	11.1	£332	£185
	100 to 150 kW	968 m ²	32.2	12.9	11.5	11.1	£215	£185
	150 to 250 kW	1,613 m ²	32.2	12.9	11.0	10.6	£215	£177
	250 kW to 5 MW	32,258 m ²	32.2	8.9	7.1	6.9	£148	£114
Wind	< 1.5 kW	2.5m	37.9	37.9	35.8	21.7	£632	£361
	1.5 to 15 kW	9m	29.3	29.3	28.0	22.7	£488	£378
	15 to 100 kW	20m	26.5	26.5	25.4	23.7	£442	£394
	100 to 500 kW	43m	20.6	20.6	20.6	18.0	£343	£301
	500 kW to 1.5 MW	70m	10.4	10.4	10.4	9.8	£173	£163
	1.5 to 5 MW	2 x 100m	4.9	4.9	4.9	4.2	£82	£69
Micro CHP	< 2 kWe		11.0	11.0	11.0	12.9	£183	£215
Hydro	<15 kWe		21.9	21.9	21.9	21.6	£365	£360
	15 to 100 kWe		19.6	19.6	19.6	20.2	£327	£337
	100 to 200 kWe		12.1	12.1	12.1	16.0	£202	£266

PV panel area based on 15% efficient monocrystalline panels.

Cost of carbon on 1tCO₂ = 1667 kWh using UK emission factor of 0.6 kgCO₂e/kWh.

Tariffs don't include an electricity export tariff of 4.64 p/kWh.

Table 1 UK feed in tariffs between 2010 and 2013 (source: Ofgem)

Renewable Heat Incentive

In April 2011, the UK introduced the world's first feed-in tariff equivalent for heat, called the Renewable Heat Incentive (RHI). It was introduced because very little of the UK's heating energy, which accounts for about 46% of the greenhouse emissions,⁴ is sourced from renewable energy systems. The RHI works in a similar way to the electricity feed-in tariff, with payments made for the kWh of thermal energy (heat) produced. This is measured using heat meters. Table 2 shows the RHI tariffs valid in July 2013.⁵

System	Capacity (kW _{th})	Tariff (p/kWh)	Tariff paid per tCO ₂ offset	Comments
Biomass	< 200	8.6	£387	Tier 1 - for first 1314hrs x kWth capacity
		2.2	£99	Additional heat above Tier 1
	200 to 1000	5.0	£225	Tier 1 - for first 1314hrs x kWth capacity
		2.1	£95	Additional heat above Tier 1
	> 1000	1.0	£45	
GSHP	< 100	4.8	£216	CoP must be better than 2.9
	> 100	3.5	£158	
Solar Thermal	< 200	9.2	£414	
Biomethane & Biogas	< 200	7.3	£329	Excludes landfill gas

Cost of carbon on 1 tCO₂ = 4,500 kWh using UK emission factor of 0.2 kgCO₂e/kWh for natural gas and a boiler efficiency of 90%. Solar panel area for 200 kW_{th} is approximately 280 m² based on 1 m² = 0.7 kW_{th}.⁶

Table 2 RHI tariffs in 2013 (source: Ofgem)

2. BENEFIT OF TARIFFS FOR BUILDING X AND HOTEL Y

The cash flows so far have ignored the benefit of government incentives, which, depending on their generosity, can dramatically change the financial evaluation. These can take the form of grants to help fund the upfront cost of the system, or payments based on the metered renewable energy generated (e.g. feed-in tariffs).

The UK RHI tariff is 9.2 p/kWh (refer to Table 2) for the solar thermal system on Building X described in Chapter 7 of the book – refer Tables 7.3 and 7.4. The system generates 27,000 kWh_{th} each year so this provides an annual revenue of £2,489 in addition to the energy cost saving of £1,050. The tariff is index linked and so increases each year. It is paid for a period of 20 years.

Undertaking the same calculations as in Chapter 7 with a capital cost of £32,000, but with an annual cash benefit of £3,534 per annum gives:

- Simple payback = 9 years (30 years without RHI)
- Net present cost after 15 years = -£5,182 (£18,800 without RHI)
- Cost of CO₂ after 15 years = -£58/tCO₂e (£210 without RHI)

This is a substantial improvement in financial performance, and is equivalent to an internal rate of return (IRR) of 7% after 15 years (compared to -8% without the RHI). The internal rate of return is used in capital budgeting to measure and compare the profitability of investments. It is called internal because it does not incorporate environmental factors (e.g., the interest rate or inflation).

The financial benefit of the FiTs and RHI on Building X and Hotel Y are shown in Table 3 and Table 4 respectively.

	saving in CO ₂ e	System size (kW)	Capital Cost	Annual energy (kWh)	FiT / RHI per kWh	FiT / RHI payment	Energy cost saving	Total saving	Payback without FiT / RHI	Payback with FiT / RHI	IRR after 15 years
Solar thermal	1%	45	£32,000	27,000	£0.092	£2,484	£1,050	£3,534	30	9	7%
Biomass boiler	9%	400	£245,000	509,600	2 tier	£25,480	-£7,761	£17,719	none	14	1%
Heat pump	4%	>100	£360,000	630,000	£0.035	£22,050	£7,921	£29,971	45	12	3%
Photovoltaics	4%	96	£144,170	75,647	£0.111	£8,397	£7,565	£15,962	19	9	7%
Wind turbine	1%	24	£120,000	16,819	£0.237	£3,978	£1,682	£5,660	71	21	-4%

Tier 1 biomass tariff limit is 400 kWe x 1314 hours = 525,600 kWh.
 Total payments = 5.0p/kWh x 509,600 = £25,480

Table 3 Financial benefit of FiTs and RHI for Building X's renewable systems

	saving in CO ₂ e	System size (kW)	Capital Cost	Annual energy (kWh)	FiT / RHI per kWh	FiT / RHI payment	Energy cost saving	Total saving	Payback without FiT / RHI	Payback with FiT / RHI	IRR after 15 years
Solar thermal	2%	140	£100,000	83,653	£0.092	£7,696	£3,253	£10,949	31	9	7%
Biomass boiler	28%	825	£350,000	1,692,600	2 tier	£66,982	-£25,776	£41,206	none	8	8%
Heat pump	7%	>100	£360,000	1,350,000	£0.035	£47,250	£15,000	£62,250	24	6	15%
Photovoltaics	4%	96	£144,170	75,647	£0.111	£8,397	£7,565	£15,962	19	9	7%
Wind turbine	1%	24	£120,000	16,819	£0.237	£3,978	£1,682	£5,660	71	21	-4%

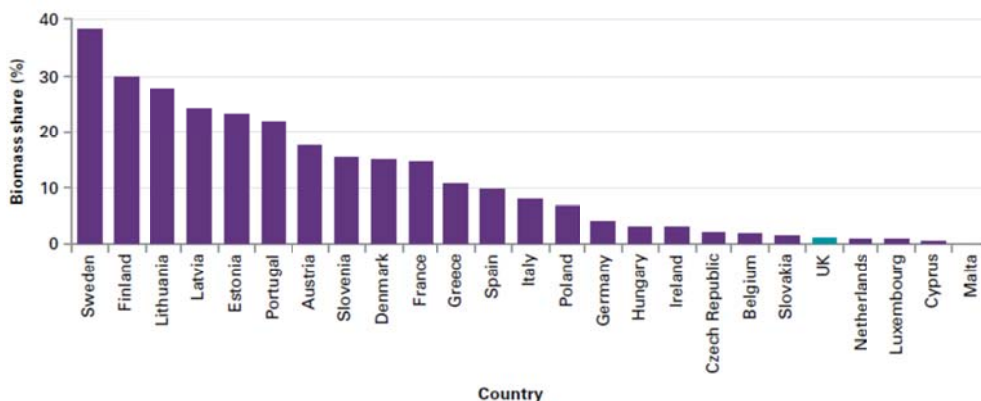
Tier 1 biomass tariff limit is 825 kWe x 1314 hours = 1,084,050 kWh.
 Total payments = 5.0p/kWh x 1,084,050 + 2.1p/kWh x 608,550 = £66,982

Table 3 Financial benefit of FiTs and RHI for Hotel Y's renewable systems

Notes

All websites were accessed on 31 August 2013 unless noted otherwise.

1. Refer to *Information Paper 25 – The rising cost of energy and carbon* for discussion on the price of carbon.
2. The NSW Solar Bonus Scheme started on 1 January 2010 and provided a payment of 60c/kWh for electricity generated from photovoltaic panels or wind turbines up to 10kW in capacity. There were 2,900 installations at the start of 2009, and by October 2010 applications for over 80,000 systems (193MW) had been received. At the same time, the price of installing PV had more than halved compared to 2009 meaning that payback of a domestic 1.5 kilowatt (kW) system reduced to around 2 years compared to 8 years when the Scheme was first announced. On 27 October 2010, just 10 months after its introduction, the tariff was cut from 60c/kWh to 20c/kWh, and the scheme capped at 300MW to reduce the cost burden to other electricity consumers. The cost per tonne abated was \$650/tonne (60c/kWh x 1.08kgCO₂/kWh) which is around £350/tonne. *Source: NSW Solar Bonus Scheme, Statutory Review Report to the Minister for Energy, October 2010*
3. <http://www.ofgem.gov.uk/Sustainability/Environment/fits/tariff-tables/Pages/index.aspx>
4. Page 7 of the *Renewable Heat Incentive: Consultation on the proposed RHI financial support scheme*, DECC Feb 2010. The UK government has set a target that 12% of heat should come from renewable sources by 2020. The UK biomass heat market is currently small. The graph below from the Carbon Trust publication *CTG 012 Biomass heating: A practical guide for potential users* shows the shares of biomass in the national heating markets of EU countries in 2006.



5. <https://www.ofgem.gov.uk/environmental-programmes/renewable-heat-incentive-rhi/tariffs-and-payments>
6. *The IEA Solar Heating and Cooling Programme and the Solar Industry agree on a common methodology to calculate the installed capacity of solar thermal collectors*, IEA explanation note, 2004 www.iea-shc.org/Data/Sites/1/documents/statistics/Explanzation_Note-New_Solar_Thermal_Statistics_Conversion.pdf