

Optimising investment in FIT and RHI technology



CLIMATECONSULTING

East Midlands CAN Conference
8th December 2011

Tom Vosper

E: tom.vosper@climate-consulting.co.uk

T: 020 8633 9801

W: www.climate-consulting.co.uk

Contents



CLIMATECONSULTING

- About Climate Consulting
- Feed in Tariff
- Renewable Heat Incentive
- Optimising your investments
- Activities & Case Studies

Climate Consulting Services

Housing Stock

- Strategy development
- Scheme audits
- PV consultancy
- Energy modelling
- Project management
- Planning and architectural support
- Post occupancy monitoring
- Finance/business model development

Schools & Commercial Stock

- Detailed EE & RE audits
- Installation management – tendering, planning, building control
- Site manager & bursar energy training
- Lessons and assemblies
- Electrical monitoring and voltage optimisation
- Energy management programmes

New Build Schemes

- Code for Sustainable Homes
- BREEAM office, multi-residential, health care and education
- Low and zero carbon technology appraisal
- Energy modelling (SAP, SBEM, PHPP)
- PassivHaus Design
- Masterplanning
- Post-occupancy Monitoring

Planning & Policy Support

- Evidence bases for sustainability policies
- Sustainability expertise for development control throughout planning process
- Training planning, policy & building control staff in current legislation, technologies and appraisal methods

Transport Services

- Travel planning, smarter driving, fleet reviews, strategy & policy development, bespoke consultancy

Background to the FIT



CLIMATECONSULTING

- The Feed in Tariff came into effect in April 2010 giving homeowners and organisations the opportunity to gain financially in three ways:
 - Generation tariff paid on all electricity generated (rates vary with technology and scale of system)
 - Export tariff paid on all electricity exported to the grid (3.1p/kWh fixed rate or option to sell electricity on the open market)
 - Fuel bill savings (obviously applicable to the amount of electricity used on site)
- Until August 2010 Local Authorities were missing out on the export tariff because they weren't allowed to sell electricity to the grid but the government has now lifted that prohibition



- Tariffs rise with inflation
- Tariffs will degress over time
- Emergency tariff review of all >50kWp tariffs now complete
- Next tariff review April 2012

FIT – current tariffs



CLIMATECONSULTING

Energy Source	Scale	Tariff (p/kWh)	Duration (years)
Anaerobic digestion	≤250kW	14.0	20
Anaerobic digestion	>250kW - 500kW	13.0	20
Hydro	≤15 kW	20.9	20
Hydro	>15 - 100kW	18.7	20
Micro-CHP	<2 kW	10.5	10
Solar PV	≤4 kW new	37.8	25
Solar PV	≤4 kW retrofit	43.3	25
Solar PV	>4-10kW	37.8	25
Solar PV	>10 - 50kW	32.9	25
Solar PV	>50 - 150kW	19.0	25
Solar PV	>150 - 250kW	15.0	25
Solar PV	>250kW - 5MW	8.5	25
Solar PV	Standalone	8.5	25
Wind	≤1.5kW	36.2	20
Wind	>1.5 - 15kW	28.0	20
Wind	>15 - 100kW	25.3	20
Wind	>100 - 500kW	19.7	20

Changes to the FIT



CLIMATECONSULTING

- 1st August 2011 – generation tariffs slashed for all systems over 50kWp
- Tariff bands restructured in the mid-level
- 31st October launch of consultation on proposals for the comprehensive review...



Proposed changes to the FIT (I)



CLIMATECONSULTING

- The new proposed tariffs would apply to all new solar PV installations with an eligibility date on or after 12 December 2011.
- Post 12.12.2011 installations would receive the current tariff before moving to the lower tariffs on 1 April 2012.
- Consumers who already receive FITs will see their existing payments unchanged.
- Those with an eligibility date on or before 12 December will receive the current rates for 25 years.
- The eligibility date of a project is based on it being commissioned (in working order) and having its request for accreditation received by a FIT licensee (schemes up to 50kWp) or Ofgem (more than 50kWp).

Proposed changes to the FIT (II)



CLIMATECONSULTING

How aggregation is expected to work with the current review as it stands is:

- Currently the total PV system would not be aggregated in size therefore each system would get the current generation tariff if installed and commissioned before the 12.12.11.
- If installed after the 12.12.11 the system would get the proposed tariff
- If installed after the 01.04.12 the system would get the aggregate tariff rate which is 80% of the proposed tariff

What does this do to the financial returns available from PV systems?



Band (kW)	Current generation tariff (p/kWh)	Proposed generation tariff (p/kWh)	Percentage Reduction (%)	April 2012 Aggregate Tariff (p/kWh)	Aggregate tariff reduction from current (%)
≤4kW (new build)	37.8	21	44%	16.8	56%
≤4kW (retrofit)	43.3	21	52%	16.8	61%
>4-10kW	37.8	16.8	56%	13.44	64%
>10-50kW	32.9	15.2	54%	12.16	63%
>50-100kW	19	12.9	32%	10.32	46%
>100-150kW	19	12.9	32%	10.32	46%
>150-250kW	15	12.9	14%	10.32	31%
>250kW-5MW	8.5	8.5	0%	6.8	20%

Likely returns



CLIMATECONSULTING

Size of PV (kWp)	System output used on site (%)	CAPEX Ex VAT (£)	Inverter cost (£) [Yr10 & 20]	Current			Proposed			Aggregated (01.04.2012)		
				Tariff (p/kW)	25 Year NPV (£)	IRR (%)	Tariff (p/kW)	25 Year NPV (£)	IRR (%)	Tariff (p/kW)	25 Year NPV (£)	IRR (%)
10	50%	-30,000	-1,800	37.80	44,850	14.60	16.80	6,828	5.47	13.44	744	3.72
50	50%	-130,000	-7,800	32.90	204,589	15.11	15.20	44,354	6.38	12.16	16,833	4.64
4	100%	-14,000	-1,120	43.30	22,104	15.16	21.00	5,954	7.03	16.80	2,912	5.30
10	100%	-30,000	-1,800	37.80	52,878	16.22	16.80	14,856	7.50	13.44	8,773	5.95
50	100%	-130,000	-7,800	32.90	244,731	16.96	15.20	84,496	8.61	12.16	56,975	7.05

But...



CLIMATECONSULTING

- Installers expect supply prices to continue falling
- Installers are proposing to drop their prices to compensate the loss in Feed in Tariff
- DECC may change the cut off date from 12/12/11 due to legal complications

Case Study: PV analysis for Epping Forest



CLIMATECONSULTING

- Housing stock – list of addresses
- GIS and GoogleEarth Pro used to locate properties, measure roof space, orientation, pitch, shading etc.
- System sizing and output calculations for each property
- Cash flow and carbon analysis conducted for each property
- Database of results created to allow Epping Forest to define the terms of their investment

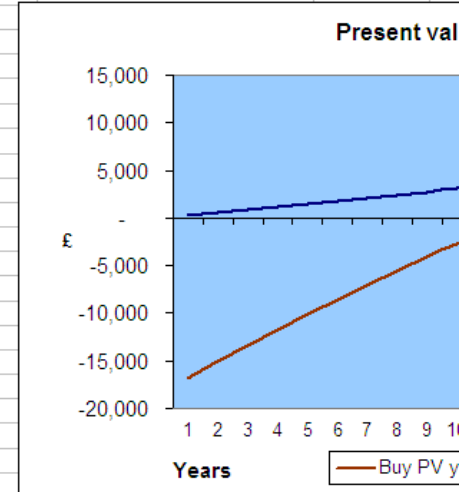


Model looks something like this...



CLIMATECONSULTING

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		1. Site				3. Tariff						
3		Annual elec consumption	5000 kWh			FIT tariff	PV >4-10kW	0.378 £/kWh				
4		Percentage used in day	50%			Export tariff		0.03 £/kWh				
5		Percentage used in night	50%									
6		Unit price in day	0.085 £/kWh			4. Financial Variables						
7		Unit price in night	0.11 £/kWh			Inflation	2.5%					
8		2. System - costs & outputs				Discount rate (own system)	5.00%					
9		PV system size	5.00 kWp			Discount rate (3rd party)	2.50%					
10		System output per kWp (kWh)	850.0									
11		Bulk purchase discount?	15%									
12		System CAPEX (ex. VAT)	18,700 £			Fossil / electricity inflation	5.0%					
13		System CAPEX (inc. VAT)	19,635 £			VAT rate applied	5.0%					
14		Inverter costs	1,496 £			Client VAT registered?	Yes	Ex. VAT				
15		Predicted Yr 0 output	4250 kWh			5. Carbon factors						
16		% used on site	80%			Carbon factor (kgCO2/kWh)	0.529 kgCO2/kWh					
17		Units used on site	3400			Carbon offset (Yr1)	2,248 kg					
18		Units exported	850			Total carbon offset (over 25 yrs)	50,379 kg					
19		Annual maintenance charge	0.50%			£capex/tCO2 saved (over 25 y	-371 £/t					
20						£NPV/tCO2 saved (over 25 yrs	241 £/t					
21												
22		Buy your own PV model - cashflow										
23		Year	0	1	2	3	4	5	6	7	8	9
24		Percentage of Yr 0 system output	100%	98.4%	97.6%	96.8%	96.0%	95.2%	94.4%	93.6%	92.8%	92.0%
25		Costs										
26		CAPEX + replacememtn inverters	- 18,700									
27		Annual maintenance	- 94	- 96	- 98	- 101	- 103	- 106	- 108	- 111	- 114	- 117
28		Total costs	- 18,794	- 96	- 98	- 101	- 103	- 106	- 108	- 111	- 114	- 117
29		Income										
30		Feed in Tariff	1,607	1,620	1,647	1,675	1,702	1,730	1,759	1,787	1,816	1,846
31		Export tariff	26	26	26	27	27	28	28	28	29	29
32		Electricity bill savings	289	299	311	324	337	351	366	381	396	412
33		Total income	1,921	1,945	1,984	2,025	2,067	2,109	2,152	2,196	2,242	2,288
34		Profit / loss	- 16,873	1,849	1,886	1,924	1,963	2,003	2,044	2,085	2,128	2,171
35		Present value of profit / loss	- 16,873	1,761	1,711	1,662	1,615	1,570	1,525	1,482	1,440	1,399
36		Present value of cashflow	- 16,873	15,112	13,401	11,739	10,123	8,554	7,029	5,547	4,107	2,707
37		NET PRESENT VALUE	12,145									
38												
39		3rd party funding model - cashflow										
40		Year	0	1	2	3	4	5	6	7	8	9
41		Income										
42		Electricity bill savings	289	299	311	324	337	351	366	381	396	412



Background to the RHI



CLIMATECONSULTING

- Previous grant support mechanisms (e.g. Clear Skies, LCBP, BECG)
- RHI provides revenue based payments not capital support (except RHPP – see next slide)
- No export tariff
- This leaves two income streams from renewable heat projects:
 - Fossil fuel savings
 - The relevant RHI tariff



Strands of RHI



CLIMATECONSULTING

1. Non-domestic RHI should be live very soon (this scheme includes communal residential systems)
2. Domestic (individual) RHI should launch in Autumn 2012 (with Green Deal)
3. RHPP
 - a) The Renewable Heat Premium Payments (RHPP) are basically a grant for individual domestics and are available now
 - b) There was a specific Social Housing RHPP call (deadline 15th Sept 2011)



Points to note on RHI



CLIMATECONSULTING

1. Again RPI linked tariffs
2. Generation tariffs paid for 20 years for all technologies
3. Non-domestic RHI payments based on heat meter readings
4. Domestic RHI may use metering, or may “deem” heat requirement, or another method altogether (details not yet released)



RHPP table



CLIMATECONSULTING

Technology	Level of support (per unit)
Solar thermal	£300
Air source heat pumps	£850
Biomass boilers	£950
Ground source heat pumps	£1250

RHI tariff table (non-domestic)



Levels of support					
Tariff name	Eligible technology	Eligible sizes	Tariff rate (pence/kWh)	Tariff duration (Years)	Support calculation
Small commercial biomass	Solid biomass including solid biomass contained in Municipal Solid Waste and CHP	Less than 200 kWth	Tier 1: 7.9	20	Metering. Tier 1 applies annually up to the Tier Break, Tier 2 above the Tier Break. The Tier Break is: installed capacity x 1,314 peak load hours, i.e.: kWth x 1,314
Medium commercial biomass			200 kWth and above; less than 1000 kWth		
Large commercial biomass		1000 kWth and above			
Small commercial heat pumps	Ground-source heat pumps; Water-source heat pumps; deep geothermal	Less than 100 kWth	4.5	20	Metering
Large commercial heat pumps		100 kWth and above	3.2		
Solar collectors	Solar collectors	Less than 200 kWth	8.5	20	Metering

Case Study: Kent Schools Biomass Appraisal



CLIMATECONSULTING

- 1,000 schools assessed in desk-based study
- 45 schools chosen for site visit and further assessment
- 22 schools found to be feasible for wood fuel heating with full technical and financial report for each
- Equates to a potential 1,800 tonnes of CO₂ savings p.a.
- Creating demand for 1,400 tonnes of wood fuel p.a.
- 3 schools now installed (500kW chip boiler, 150kW chip boiler, 150kW pellet boiler)
- Many schools feasible for other renewable energy technologies (PV, wind, GSHP etc.)

positioned side by side. The hook-lift bin approach requires that the fuel supply be coordinated with the installation. A hook-lift is shown in Figure 4.5.

Figure 4.5 Hook lift bin storage

Figure 4.6 Area next to plant room

From the initial survey, it is likely that there would be sufficient space for the siting of a hook-lift bin adjacent to the plant room, where there are currently two container units (shown in Figure 4.8). The path that currently runs between the container units and plant room would have to be re-routed.

4.1.6 Fuel Requirement

As already discussed, Valley Park Community School currently consumes around 600,000 kWh of heat per year. With 70% of annual demand being met through the chip boiler – 420,000 kWh – some 507m³ (145.5 tonnes) of wood chip will be required each year. The remaining 180,000 kWh heat demand will be met through gas.

works (CEN) to all schools, focusing on a final list of forty-five schools.

technologies: solar turbines, stand alone schools have flat roofs, re exposed and remote. Ground source heating requiring a new building under-floor heating.

financially and economically not all feasible schools by. A full analysis has not produced for those schools.

the site has been assigned a priority rating out of 5.

Figure 4.3 Current plant room layout

The store is of breezeblock construction but, according to the site manager, could be dismantled if this was necessary for the installation of a biomass boiler. The dimensions of this store are approximately 3.5m by 2.0m.

4.1.5 Fuel Storage

The current oil tanks are some 20m away from the plant room so oil is pumped through pipes underground to reach the boilers. This area would not be suitable for storage of wood fuel due to the remoteness from the boiler house. The current oil tanks are shown in Figure 4.4.

Figure 4.4 Current oil tanks

The most suitable storage solution would be to utilize the space immediately adjacent to the boiler house. Excavating down is probably out of the question due to the presence of a large tree near this area who's roots would inevitably be damaged by such a procedure. The remaining options are to build a bulk storage hopper above ground which would need a specialist delivery vehicle (high lift topper trailer) or a ramp, for which there is no space.

A better option would be the use of hook-lift bins. Hook-lift bins are filled with wood chip off site then delivered as a container to the site where they connect directly to the fuel transfer mechanism that carries the chip to the boiler. Normally two bins holding around 30m³ each are

consumption

Fig 4.6 Consumption

Figure 4.7: Feasible schools divided by fuel type and priority. A map of Kent with schools marked by colored dots. A legend indicates fuel type (Green chip, Wood chip, Pellet) and priority rating (1-5).

Feasible schools divided by fuel type and priority

Page 4 of 238

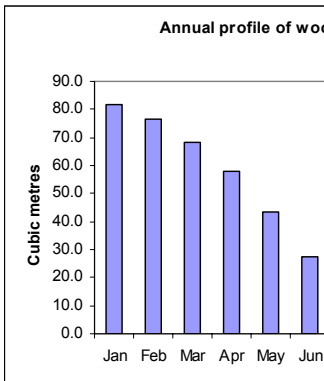
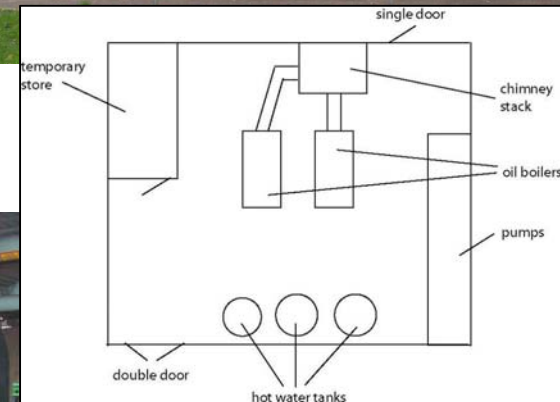
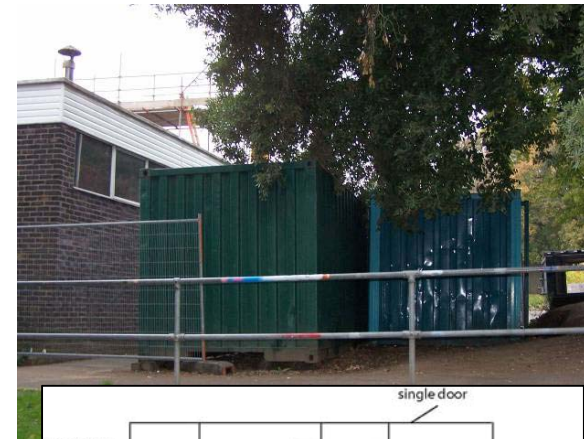
Page 13 of 238

Valley Park Community School, Maidstone



CLIMATECONSULTING

- On-site discussions with Head and Site Manager – already keen on renewable energy
- Survey of school and plant room
- Completion of individual report, recommending 500kW wood chip boiler with hook-lift bin delivery system
- LCBP and EDF grants secured
- System installed by Econergy in August 2008 and working well
- MC30 wood chip supplied by John LP via SEWF and is transported 12 miles from source



Valley Park: Grants vs RHI



CLIMATECONSULTING

- CAPEX of ~£450k
- Gas / oil install would have been ~£250k anyway so £200k extra
- Total grant support of about £100k so £100k additional cost to client
- Fuel savings of $\sim 700,000 \times 0.025 = \text{£}17,500$ p.a.
- Maintenance costs of ~£3,000 p.a.
- Running cost savings of £14,500 without RHI
- ~7 year payback on extra investment and lifetime savings of ~£190k

Installed before 15/7/09 so they will not get RHI but if they were installing today:

- No grant support so £200k additional cost to client
- Same £14,500 revenue from fuel saving minus maintenance
- RHI payments of: $(500 \times 1314 \times 0.049) + (500 \times 100 \times 0.020) = \text{£}33,193$ p.a.
- Overall revenue and savings of ~£47,700
- ~4 year payback on extra investment and lifetime savings of ~£954k

How can you optimise your investments?



CLIMATECONSULTING

- Optimising financial return or CO2 saving?
- Using the right technologies for our situation
 - Technologies – higher capex, lower risk, lower maintenance or lower capex, higher risk, higher maintenance
 - Combination of technologies
 - The right buildings or situations
- Sizing technologies shrewdly - look at where the tariff levels change
- Bulk purchase discounts
 - Own estate
 - Combining with other 'customers'
 - Using a framework
- Achieving best financial terms
 - Size of investment
 - Investment risk
 - Security
- For electricity generation technologies, optimising onsite / offsite usage
- What about energy efficiency?

Activity 1 – Income from a PV system



CLIMATECONSULTING

- 40m² roof area (roughly 5kWp PV system)
- Optimal orientation & pitch and no shading
- Costing £15,000
- 50% of electricity is used onsite
- 13p/kWh paid for peak electricity

- What is the income?
- What is the simple payback?

Activity 1 – Income from a PV system



CLIMATECONSULTING

- 40m² roof area (roughly 5kWp PV system)
- Optimal orientation & pitch and no shading
- Costing £15,000
- 50% of electricity is used onsite
- 13p/kWh paid for peak electricity
- What is the income?
- What is the simple payback?

- 5 kWp x 850 = 4,250 kWh electricity generated (yr 1)
- Generation tariff income: $4,250 \times 0.378 = \text{£}1,607$
- Export tariff income: $4,250 \times 50\% \times 0.031 = \text{£}66$
- Bill saving: $4,250 \times 50\% \times 0.13 = \text{£}276$
- Total “income” = $\text{£}1,949$ (in the first year)
- Simple payback is just: $\text{£}15,000 / \text{£}1,949 = 7.7$ years

**What if we use proposed tariff?
(£714 using proposed 16.8p tariff)
(Export tariff unchanged)
(Bill saving unchanged)
(Total down to £1,056)
(Payback up to 14.2 years)**

Question - What factors have we ignored?

Discussion topics



CLIMATECONSULTING

1. What effect would adding a solar thermal system have to the finances of the project?
2. How can we optimise our investment through choosing the right business model?
3. How can we optimise the return from a biomass system?

Discussion topics



CLIMATECONSULTING

What effect would adding a solar thermal system have to the finances of the project?

- Introducing ST will limit (reduce) the size of the PV system (because the roof isn't any bigger)
- The £/kWp goes up as the PV system size drops
- But the ST system probably won't be huge because it will be capped by hot water demand
- Potential to take advantage of ST being slightly less fussy about shading

Discussion topics



CLIMATECONSULTING

How can we optimise our investment through choosing the right business model?

- What skills & expertise do you have in house?
- Cost of finance – internal / external?

Discussion topics



CLIMATECONSULTING

How can we optimise the return from a biomass system?

- Looking at tariff bands
- Considering the tier 1 operation
- How can you “export” heat? - Heat network

Optimising investment in FIT and RHI technology



CLIMATECONSULTING

SW CAN Conference
28th September 2011

Tom Vosper

E: tom.vosper@climate-consulting.co.uk

T: 020 8633 9801

W: www.climate-consulting.co.uk