

# Optimising investment in FIT and RHI technology

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- The RHI
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# CEN Consulting

- An impartial environmental consultancy
- Established in 1997, CEN have a 13 year track record of successful project delivery in:
  - Fuel poverty
  - ESTac
  - Sustainable energy and micro-generation
  - Sustainability consultancy – energy, transport, water and waste
- 20 technical experts, and the largest installer network in the UK
- In 2010, CEN merged with Climate Energy

# CEN / Climate Consulting – Summary of 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

# FIT and the opportunity

- 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 Local Authorities were missing out on the export tariff because you 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 underway
- Tariff review April 2012

# FIT – current tariffs

Energy Source	Scale	Tariff (Apr 2011 – Mar 2012) (p/kWh)	Duration (years)
Anaerobic digestion	Up to 500kW	12.1	20
Anaerobic digestion	>500kW	9.4	20
Hydro	Up to 15 kW	20.9	20
Hydro	>15 - 100kW	18.7	20
Hydro	>100kW - 2MW	11.5	20
Hydro	>2MW - 5MW	4.7	20
Micro-CHP	<2 kW	10.5	10
Solar PV	Up to 4 kW new	37.8	25
Solar PV	Up to 4 kW retrofit	43.3	25
Solar PV	>4-10kW	37.8	25
Solar PV	>10 - 100kW	32.9	25
Solar PV	>100kW - 5MW	30.7	25
Solar PV	Standalone	30.7	25
Wind	Up to 1.5kW	36.2	20
Wind	>1.5 - 15kW	28.0	20
Wind	>15 - 100kW	25.3	20
Wind	>100 - 500kW	19.7	20
Wind	>500kW - 1.5MW	9.9	20
Wind	>1.5MW - 5MW	4.7	20
Existing generators transferred from RO		9.4	to 2027

# Renewable Heat Incentive

- Previous grant support mechanisms (e.g. Clear Skies, LCBP, BECG)
- RHI provides revenue based payments not capital support (like the FIT)
- No export tariff
- This leaves two income streams from renewable heat projects:
  - Fossil fuel savings
  - The relevant RHI tariff
- Based upon metered heat produced (there was some previous discussion about heat being 'deemed' and this may still be the case for domestic schemes)



# RHI tariff tables

Tariff name	Eligible technology	Eligible sizes	Tariff rate (p/kWh)
Small biomass	Solid biomass; Municipal Solid Waste (incl. CHP)	Less than 200 kWth	Tier 1: 7.6
			Tier 2: 1.9
Medium biomass		200 kWth and above; less than 1000 kWth	Tier 1: 4.7
	Tier 2: 1.9		
Large biomass	1000 kWth and above	2.6	
Small ground source	Ground-source heat pumps; Water-source heat pumps; Deep geothermal	Less than 100 kWth	4.3
Large ground source		100 kWth and above	3.0
Solar thermal	Solar thermal	Less than 200 kWth	8.5
Biomethane	Biomethane injection & biogas combustion, except landfill gas	Biomethane all scales; biogas < 200 kWth	6.0



# Renewable Heat Incentive

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- All RHI tariffs are for 20 years
- For small and medium sized biomass installations there is a two-tier tariff system:
  - Tier 1 is for the first 1314 hours of full load usage
  - Tier 2 is for usage beyond this

# How can we optimise our investments?

- Optimising financial return or CO<sub>2</sub> 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?

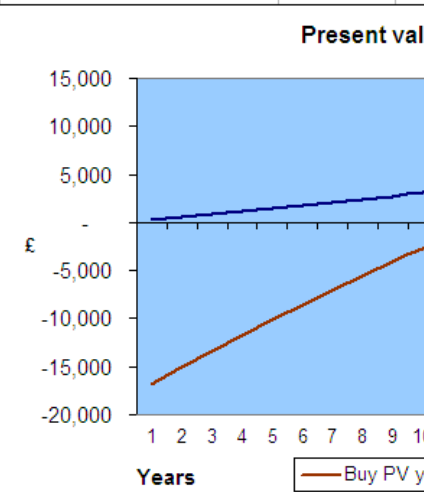
# Activity 1 – Income from a PV system

- 40m<sup>2</sup> roof area (roughly 5kWp PV system)
- Optimal orientation & pitch and no shading
- Costing £22,000
- 50% of electricity generated used onsite
- 10p/kWh paid for peak electricity
  
- What is the income?
- What is the simple payback?

# Activity 1 – Income from a PV system

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- Optimal orientation & pitch and no shading
- Costing £22,000
- 50% of electricity generated used onsite
- 10p/kWh paid for peak electricity
  - What is the income?
  - What is the simple payback?
  
- $5 \text{ kWp} \times 850 = 4,250 \text{ kWh}$  electricity generated in year 1
- Generation tariff income:  $4,250 \times 0.378 = \text{£}1,606.50$
- Export tariff income:  $4,250 \times 50\% \times 0.03 = \text{£}63.75$
- Bill saving:  $4,250 \times 50\% \times 0.10 = \text{£}212.50$
- Total “income” =  $\text{£}1,882.75$  (in the first year)
- Simple payback is just:  $\text{£}22,000 / \text{£}1,882.75 = 11.7$  years
  
- **Question - What factors have we ignored?**
- CEN’s model gives an NPV of  $\text{£}6,414$  and an IRR of 7.89%

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		<b>1. Site</b>				<b>3. Tariff</b>						
3		Annual elec consumption	5000 kWh			FIT tariff	PV >4-10kW					
4		Percentage used in day	50%			Export tariff	0.378 £/kWh					
5		Percentage used in night	50%				0.03 £/kWh					
6		Unit price in day	0.085 £/kWh			<b>4. Financial Variables</b>						
7		Unit price in night	0.11 £/kWh			Inflation	2.5%					
8		<b>2. System - costs &amp; outputs</b>				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%			Fossil / electricity inflation	5.0%					
12		System CAPEX (ex.VAT)	18,700 £			VAT rate applied	5.0%					
13		System CAPEX (inc. VAT)	19,635 £			Client VAT registered?	Yes					
14		Inverter costs	1,496 £									
15		Predicted Yr 0 output	4250 kWh			<b>5. Carbon factors</b>						
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 yrs)	-371 £/t					
20						£NPV/tCO2 saved (over 25 yrs)	241 £/t					
21												
22		<b>Buy your own PV model - cashflow</b>										
23		<b>Year</b>	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		<b>Costs</b>										
26		CAPEX + replacemtn inverters	18,700									
27		Annual maintenance	94	96	98	101	103	106	108	111	114	117
28		<b>Total costs</b>	18,794	96	98	101	103	106	108	111	114	117
29		<b>Income</b>										
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	27	28	28	29	29
32		Electricity bill savings <input checked="" type="checkbox"/>	289	299	311	324	337	351	366	381	396	412
33		<b>Total income</b>	1,921	1,945	1,984	2,025	2,067	2,109	2,152	2,196	2,242	2,288
34		<b>Profit / loss</b>	16,873	1,849	1,886	1,924	1,963	2,003	2,044	2,085	2,128	2,171
35		<b>Present value of profit / loss</b>	16,873	1,761	1,711	1,662	1,615	1,570	1,525	1,482	1,440	1,399
36		<b>Present value of cashflow</b>	16,873	15,112	13,401	11,739	10,123	8,554	7,029	5,547	4,107	2,707
37		<b>NET PRESENT VALUE</b>	12,145									
38												
39		<b>3rd party funding model - cashflow</b>										
40		<b>Year</b>	0	1	2	3	4	5	6	7	8	9
41		<b>Income</b>										
42		Electricity bill savings	289	299	311	324	337	351	366	381	396	412



## Activity 2 – How can we improve the return on our investment for this same roof?

We're going to look at three potential options:

1. Optimise the electricity consumption profile to use more of the system output onsite (assume 80% of electricity used on site)
2. Reduce system size to 4kWp (the highest FIT generation tariff bracket)
3. Install more systems and get a bulk purchase discount (assume we've got enough houses to negotiate a 15% discount)

## Activity 2 – How can we improve the return on our investment for this same roof?

### The Answers – Group 1

Optimise electricity consumption profile to use more of the system output onsite (assume 80% of electricity used on site)

- Same generation tariff at Activity 1 (£1,606.50)
- Export tariff income:  $4,250 \times 20\% \times 0.03 = £25.50$
- Bill saving:  $4,250 \times 80\% \times 0.10 = £340$
- Total “income” = £1,972
- Simple payback is  $£22,000 / 1972 = 11.2$  years

## Activity 2 – How can we improve the return on our investment for this same roof?

### The Answers – Group 2

Reduce system size to 4kWp (the highest FIT generation tariff bracket)

- $4 \text{ kWp} \times 850 = 3,400 \text{ kWh}$  electricity produced in year 1
- Generation tariff income:  $3,400 \times 0.433 = \text{£}1,472.20$
- Export tariff income:  $3,400 \times 50\% \times 0.03 = \text{£}51$
- Bill saving:  $3,400 \times 50\% \times 0.10 = \text{£}170$
- Total “income” =  $\text{£}1,693.20$
- Simple payback is  $(4/5 \times \text{£}22,000) / 1693.20 = 10.4 \text{ years}$



## Activity 2 – How can we improve the return on our investment for this same roof?

### The Answers – Group 3

Install more systems and get a bulk purchase discount (assume we've got enough houses to negotiate a 15% discount)

- New capital cost =  $£22,000 \times 0.85 = £18,700$
- Total “income” is same as Activity 1 (i.e.  $£1,882.75$ )
- Simple payback is  $£18,700 / £1,882.75 = 9.9$  years

## Activity 2 – How can we improve the return on our investment for this same roof?

We're going to look at three potentials:

1. Optimise electricity consumption profile to use more of the system output onsite (assume 80% of electricity used on site)
  2. Reduce system size to 4kWp (the highest FIT generation tariff bracket)
  3. Install more systems and get a bulk purchase discount (assume we've got enough houses to negotiate a 15% discount)
- Keeping all factors the same and just changing:
    - Onsite usage to 80% gives an NPV of £8,184 and IRR of 8.6%
    - Reducing system to 4kWp gives £8,353 and 9.6% respectively
    - A 15% bulk discount gives £10,375 and 10.3% respectively
  - Making all of these changes together gives £12,937 and 13.0% respectively!!

# Discussion topics

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 – 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 - 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 – 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

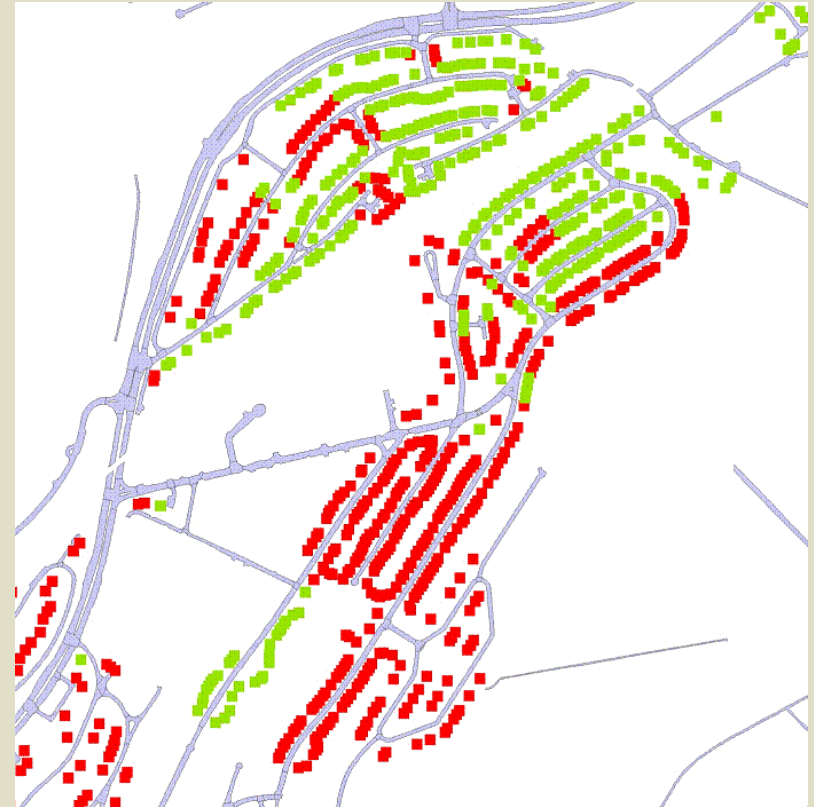
# Case Study: South East Local Authority

## The task:

- 12,000 residential properties
- Asked CEN to assess the technical and financial case for investment in PV systems and to determine the best business model for implementation and management

## The process:

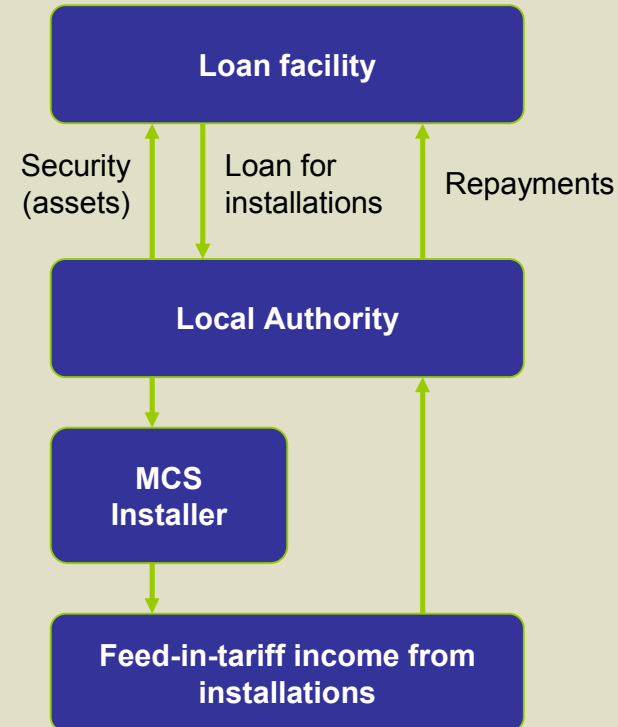
- GIS analysis of all properties – property type, roof area, orientation...
- Supply chain analysis looking at panel and inverter supply and install routes
- Technical analysis of different types of PV panel, output, cost and performance
- Financial and business modelling



# Case Study: South East Local Authority

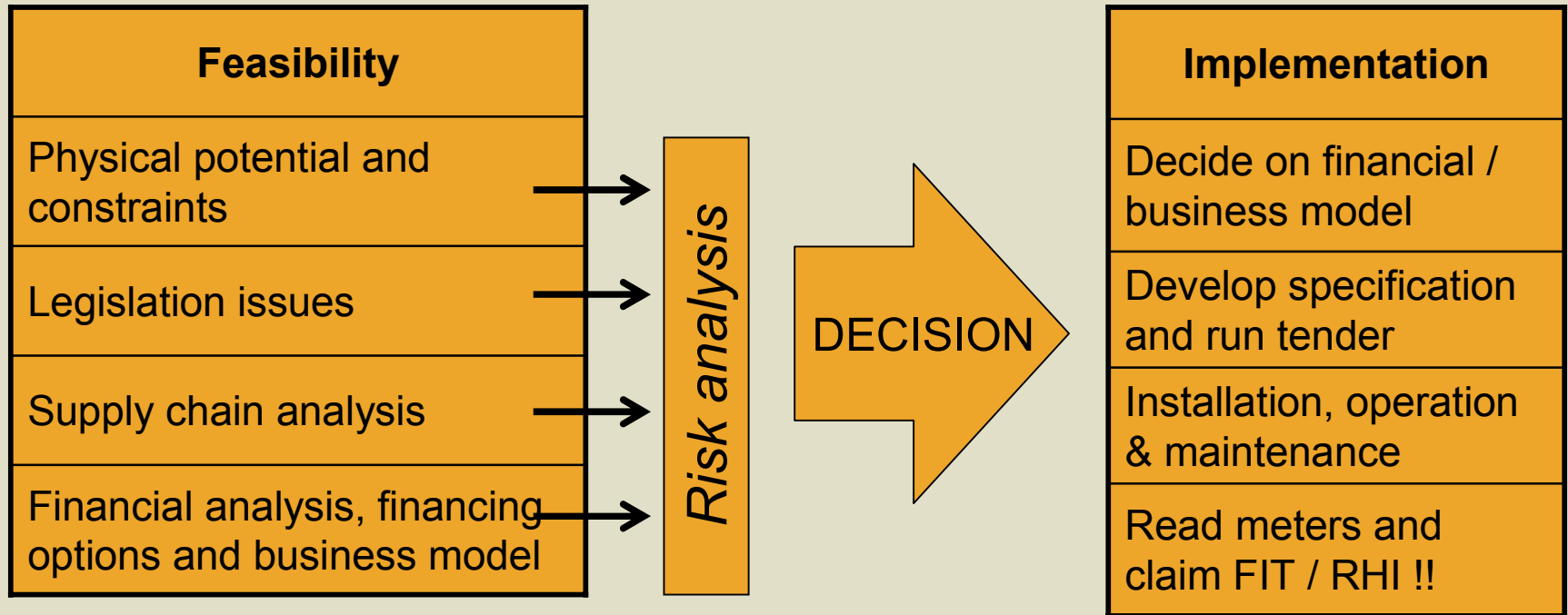
## The results:

- >1.5kWp mono-crystalline system chosen for best value and fit with stock roof areas
- 1,615 residential properties good for installation (between SE and SW)
- Different business models assessed including:
  - External ownership and management (FIT goes to installer)
  - 100% internal ownership
  - 100% ownership (via an SPV) to ringfence project risk
  - Joint ownership of SPV with a contractor / managing agent
- Financial and cost/benefit analysis performed for each option
- Around £16m capex





# So what should you do if you're interested in benefiting from the FIT / RHI?



# Getting you started

Three levels of detail...

- Option 1 – roof area overview analysis
- Option 2 – desk review of roof area, orientation, shading etc.
- Option 3 – full business plan based upon desk review of building stock

# Final thoughts...

- FIT tariff level review – April 2012
- Consult your planned maintenance programme
- Remember that trees grow
- Look at the fine print

# Questions?

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