REOC 2008

GREENPRINT FOR A RURAL PARISH

INTRODUCTION

The Energy Bill should receive its Royal Assent in late autumn 2008. BERR, the Bill's sponsor department, has proposed that renewable electricity generated by microgeneration (defined as having installed capacity of 50kW or less) will receive a feed-in tariff of £400/MWh (40p/kWh) regardless of the renewable energy technology used. It has also proposed that renewable heat will receive a new subsidy called the Renewable Heat Incentive (RHI) worth £20/MWh (2p/kWh) for renewable heat.

In all probability both these proposals will be accepted as microgeneration is unlikely to be widely adopted without a powerful price incentive. The Microgeneration Strategy has estimated that 7% of the UK's electricity demand could be met by microgeneration which, unlike larger projects such as new nuclear and the Severn Barrage, can be developed relatively quickly and help fill the 30% shortfall in electricity by 2018 identified by Professor Fell's in his recent report.

AIM

The aim of this paper is to propose a **Greenprint for a typical Rural Parish** to demonstrate how most rural parishes could achieve a measure of energy self-sufficiency thanks to the proposed feed-in tariff and RHI.

THE RURAL PARISH

Clearly all parishes differ. There are 200 parishes in Cornwall and about 10,400 in the UK. St Mabyn Parish in Cornwall has been taken as an example as it is where the author lives; it has 15 mixed farms; comprises 1,700 ha of which: 1,400 ha is farmed, 200 ha is woodland and 100 ha is unfarmed; it is bordered on one side by the River Camel and on another side by the Allen Stream. It has a population of 560, most of whom live in St Mabyn village itself. There are 240 households, a small primary school, a Grade 1 listed church, a church hall, a village shop/Post Office and a pub. There are no major employers; most who are not retired are either commuting into Bodmin of Wadebridge (both about 5 miles distant) or are self-employed.

RESOURCES

The parish has above UK average wind of 6-7m/sec on the higher ground (130m); ~1,200mm annual rainfall with springs and the two rivers; good soil suitable for silage (three or four cuts per year), winter barley, wheat, oats and maize, oil seed rape and already grows successfully miscanthus as an energy crop at 16 oven dried tonnes/ha.

AVAILABLE GRANTS

There are four main sources of grants:

a. **Energy Crops Scheme.** This is run by Natural England and gives grants of £1,000/ha for establishing short rotation coppice willow & poplar and £800/ha for planting miscanthus (elephant grass). Yields after three years should be 24 oven dried tonnes/ha for SRC willow (only one third is harvested each year – so in effect this is 8 odt/ha) and 16 odt/ha for miscanthus which is harvested each year in the spring requiring just cutting and Heston baling.

b. **Low Carbon Buildings Programme (LCBP) Phase 1 & Phase 2.** Phase 1 is a £2,500 grant per domestic house towards the cost of installation of RE systems such as ground source heat pumps (GSHP), solar thermal and roof-mounted wind-turbines. With its 240 homes, St Mabyn Parish could receive grants of £600,000 if all installed some type of RE system. It is hoped that the Energy Bill will allow clusters of houses to pool their grants so as to buy a more efficient single, and larger, communal RE system (but see c. below for another possible way of achieving this). Phase 2 meets 50% of the cost of RE equipment for public and not-for-profit buildings such as the primary school, the church hall and church. The maximum grant is £500,000 per project.

c. **Community Sustainable Energy Programme (CSEP).** This grant is similar to the Phase 2 grant above and provides up to 50% of the capital cost of RE equipment for communal facilities such as the church hall.

d. **Good Quality Combined Heat & Power (GQCHP).**

- exemption from the Climate Change Levy for all Good Quality CHP fuel inputs and electricity outputs;
- eligibility for Enhanced Capital Allowances (ECAs) to stimulate investment;
- Business Rates exception for CHP power generation plant and machinery;
- a reduction in VAT on certain domestic micro-CHP installations;
- eligibility to ROCs for the biomass element of fuel utilised in Energy from Waste CHP plants

The GQCHP grants would be ideal if a business wished to reduce its Corporation Tax liability (28% for most companies and 21% for smaller companies with profits of £300,000 or less) by becoming a stakeholder in a biomass CHP plant.

THE ENERGY REQUIREMENT

According to the National Statistics Office, in 2001 the average household domestic energy consumption was 1,960 kg of oil equivalent. This is a more useful figure than the Advertising Standards Authority figure of 3,300 kWh of electricity and 8,000 kWh of heat per household as this is based on mains gas connection. St Mabyn, like most Cornish parishes, is not on mains gas and in consequence households use a mix of calor gas, electricity and heating oil for the heating element of their household energy use. On the assumption that the 240 households use 479 tonnes of oil equivalent and that the church, school and village hall each use five tonnes of heating oil equivalent, the domestic energy requirement comes to 504 tonnes of oil equivalent.

Based on the EU figures for UK car ownership for 2006 of 463 cars per 1,000 people, St Mabyn Parish's 560 people own 260 cars with, say, an average mileage of 10,000 miles pa. At 10 miles per litre and 1,100 litres per tonne, the parish cars use 236 tonnes of oil equivalent.

Assuming each of the 15 farms uses 20 tonnes of oil equivalent for tractors, milking etc, they use 300 tonnes . To achieve energy self-sufficiency, St Mabyn Parish will need to replace the **1,040 tonnes of oil equivalent (toe)** with renewable energy. As each tonne of oil that is burnt emits 3.16 tonnes CO2e, the target of 1,040 toe can also be expressed as **3,286 tonnes CO2e**.

MICROGENERATION

As explained in the introduction above, at parish level it will make sense to take full advantage of the BERR proposed feed-in tariff for microgeneration by installing RE systems that are rated at 50kW (but no more). The new RHI subsidy should also be used where possible. Micro hydro-turbines of 50kW capacity tend to be more efficient at 70% than 50kW micro wind-turbines at 25%. The order of ability to make best use of the proposed subsidies is as follows:

a. Biomass Combined Heat & Power (CHP) plants.

b. Ground Source Heat Pumps.

c. Micro hydro.

d. Micro wind.

Anaerobic Digestion has not been included as a study commissioned by the Cornwall Agrifood Group that looked at eight Cornish scenarios using experienced German consultants concluded that AD was not viable for six of the farming scenarios and only just viable for the two largest farms, both of which were larger than any of the parish farms. Solar voltaic and solar thermal have been shown by recent studies to continue to have a long payback time.

BIOMASS CHP PLANTS

This paper has assumed that five of the 15 farms decide to install biomass CHP plants tailored to each generate 50kW of electricity (based on 90% availability). There is a choice of providers of these plants but perhaps the most appropriate is the **Organics Biomass Energy T5** plant that has the following characteristics, requirements and outputs:

The T5 requires 415 oven dried tonnes of woody feedstock – perhaps 320 odt of miscanthus grown on 20 ha and 95 tonnes of wood & sawmill waste costing about £20,000 pa.

The capital cost is £450,000 reducing to £324,000 after 28% Enhanced Capital Allowances (ECA) have been deducted.

It generates 394 MWh electricity worth at £400/MWh feed-in tariff £157,500.
It generates 866 MWh of renewable heat earning £17,300 in RHI subsidy
The farmer sells half the heat at £20/MWh to earn £11,000 pa.

It also produces 42 tonnes of bio-coal that can be briquetted for BBQs and domestic coal replacement for £300/t to earn £12,450 pa. Total Revenue is about £200,000 before operating, finance and feedstock costs of £55,000. **Net revenue £145,000.**

Contribution from five T5 biomass CHP plants towards target of 1,040 toe is: **522 toe pa.**
(Based on 11.4 MWh per toe and 42 tonnes of bio-coal equating to 32 toe).
Capital cost after ECA £1,620,000 earning £725,000 pa. Payback 27 months.

GSHPs

The church, school and village hall are all within 60 yards of each other. The village needs to build a car park on adjoining glebe land. A shared 60kW GSHP could be installed under the new car park at a cost of £60,000 which would reduce to £30,000 after a 50% CSEP or LCBP Phase 2 grant. The church would use the heat on weekends when the school and hall tend not to be in use. Assuming the heat is required for 40% of the year, the heat delivered is 210 MWh equating to **15 toe pa** after deducting the emissions from the electricity used to drive the pump**.**

Eighty of the 240 houses use their LCBP Phase 1 grants £2,500 to install 5kW GSHPs costing £6,000 each (£3,500 after the grant). The heat is used for 50% of the year generating 1,752 MWh or 1,400 MWh after electricity for the pumps is taken into account. This equates to **123 toe pa.**

GSHPs' capital cost is £310,000 saving **138 toe** worth, at £600/tonne of heating oil, £82,800 pa plus RHIs worth £39,240. Payback 33 months.

MICRO HYDRO

There is an old leat fed watermill on the Camel that could generate 300 MWh and another mill at Littlewood on the Allen that could generate 60 MWh. There is an additional good site for an impact micro-turbine using a 65 metre drop by a stream that could generate 80 MWh. These three micro hydro turbines output would equate to **39 toe pa.** The three projects might cost £300,000 and earn £176,000 pa due to the feed-in tariff of £400/MWh. After expenses, this might reduce to £145,000 pa. Payback 25 months.

MICRO WIND

Six of the farms with high suitable ground each agree to host a cluster of seven 50kW wind-turbines which are individually owned by either communal groups or charities such as the village scout hut, the Womens Institute, the RNLI et al or by not-for-profit organisations such as the Camels Rugby Club, St Enodoc Golf Club, the Church of England Primary School, the parish church et al. We might assume that 21 of the 42 wind-turbines qualify for either a CSEP or LCBP Phase 2 50% grant and that the remaining 21 are owned by the farmers and other non-grant qualifying organisations/individuals. The 50kW AOC 15/50 wind-turbine (one eight of the power of the Delabole turbines) each generate 100 MWh for a total contribution of 4,200 MWh equating to **368 toe.**

Each wind-turbine costs £135,000 to purchase and install. Those with the 50% grant for the equipment cost £70,000 each. The capital cost of the 42 wind-turbines is **£4,305,000.**

The gross revenue is £1,680,000 reducing to £1,400,000 after costs. Payback is 37 months.

Each cluster is quite small as the turbines have a swept diameter of 13 metres and require five times the swept area separation from each other so as not to interfere and thereby reduce efficiency. The turbines need to be 70m apart. Each cluster of seven turbines needs to be in a circle with a radius of 70m. The area required by each cluster is therefore 1.54 ha (3.85 acres), ground that can still be farmed.

HITTING THE 1,040 toe TARGET

RE System	MWhe	MWh heat	Bio-coal tonnes	Tonnes Oil Equivalent	CO2e tonnes saved
5 Biomass CHP plants	1,970	4,330	210	522	1,650
81 GSHPs	-	1,962	-	138	388
3 Hydro	440	-	-	39	440
42 Wind	4,200	-	-	368	1,163
TOTALS	**6,610**	**6,292**	**210**	**1,067**	**3,641**

As can be seen, St Mabyn parish has slightly exceeded its **1,040 toe** target by saving the equivalent of **1,067 toe pa**.

COST AND PAYBACK

RE System	Capex	Net Revenue	Payback
5 Biomass CHP plants	£1,620,000	£725,000	27 months
81 GSHPs	£310,000	£122,040	31 months
3 Hydro	£300,000	£145,000	25 months
42 Wind	£4,305,000	£1,400,000	37 months
TOTALS	**£6,535,000**	**£2,392,020**	**33 months**

There are few investments out there that can claim a 33 month payback. Besides greatly reducing most of the 560 parishioners' annual fuel bills, the GDP of the parish will improve by **£4,270 per head.** The village will be able to spend money collectively to restore its Grade 1 listed church, support the school, promote charitable activities in the village and generally overcome the soul-wrenching rural poverty that has afflicted so many rural communities. Rural poverty that has been accentuated recently by the sharp rise in the costs of personal transportation and utilities accentuated by the lack of public transport, mains gas and affordable housing and rising food prices.

EMPLOYMENT

The five biomass CHP plants will probably require a full time job each; the wind-turbines a crew of three; the GSHPs a team of two; and the three hydro plants might require a shared engineer for a total of 11 new skilled jobs in the parish. Those involved in the installation of the systems will

acquire skills that they can use as other parishes follow St Mabyn's lead and this could lead to a further ten jobs and perhaps four consultancy jobs.

However, the main employment opportunity may well stem from the five farm based biomass CHP plants being able to offer on site cheap heat and electricity in business units using surplus converted farm buildings. For example, heat could be used for a smithy, a pottery/ceramics, a laundry for the tourist industry, office units, greenhouses, chillers etc. Each biomass CHP plant could create 10 jobs for a total of 50 secondary jobs on top of the 25 primary jobs described above.

Many of these jobs will be filled by parishioners who would normally have had to commute into Bodmin or Wadebridge thereby reducing their mileage driven and consequent emissions.

PUMP PRIMING

Cornwall has six years of special funding provided by the EU. Finding the initial capital outlay of £6.5 million may prove difficult due to the credit crunch and the unfamiliarity of the banks with the stimulus that the Energy Bill should shortly give to microgeneration. It would help if the Convergence Fund could **lend** money to the project by, perhaps, funding the first biomass CHP plant (there are several hundred acres of miscanthus already growing within the parish and neighbouring area), the church/school/hall GSHP, one of the hydro projects and one of the wind-turbine clusters. If the loan was for half the money needed for this selection, it would require a about **£600,000** for the eventual creation of 75 long term skilled jobs.

While it would be a leap of faith, if the above were to spread eventually to all 200 Cornish parishes, the Convergence Fund's aim would be more than met; Cornwall would achieve a high degree of energy self-sufficiency which it sorely needs as it is 'on the hind tit'; the Government's ambitious target of cutting CO2e emissions by 60% by 2050 would be exceeded; and Cornwall would become a prosperous yet sustainable county without wrecking its special sense of place.

CONCLUSIONS

The Energy Bill will probably bring in a feed-in tariff for microgeneration and a renewable heat incentive which will offer rural communities the prospect of becoming self sufficient for energy with a quick payback on the RE investments they make.

St Mabyn parish would be an ideal place to demonstrate how this can be achieved, something that could be speeded if the Convergence Fund were to make loans of no more than £600,000 to start the ball rolling.

The feed-in tariff and RHI proposed in the Energy Bill could result in increased prosperity and jobs in rural communities that have for so long been in decline while tackling fuel poverty and the unaffordability of housing.

RECOMMENDATION

The Cornwall Agrifood Group, SWRDA, NFU, CLA, NCDC, CCC, Natural England and the Environment Agency use this paper as a **Greenprint for Rural Parishes.** Cornwall Agrifood or

SWRDA may wish to lead by convening an inaugural meeting to discuss the paper and decide how to proceed with its implementation.

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FOOTNOTE TO GREENPRINT FOR A RURAL PARISH

CARBON REDUCTION COMMITMENT & THE GREEN PARISH

Reference: Gage Williams' paper 'Greenprint for a Rural Parish' dated 17 Sep 08

INTRODUCTION

In the paper at reference, Gage Williams used the table below to show how much renewable electricity, heat and bio-coal could be produced by a single parish building five small biomass CHP plants, installing 81 Ground Source Heat Pumps (GSHP), six clusters of seven 50kW wind-turbines and three small hydro-turbines:

HITTING THE 1,040 toe TARGET

RE System	MWhe	MWh heat	Bio-coal tonnes	Tonnes Oil Equivalent	CO2e tonnes saved
5 Biomass CHP plants	1,970	4,330	210	522	1,650
81 GSHPs	-	1,962	-	138	388
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TOTALS	**6,610**	**6,292**	**210**	**1,067**	**3,641**

The aim of the paper was to show how a typical Cornish parish could meet its entire energy needs that were estimated to equate to 1,040 tonnes oil equivalent (toe). The table shows how the combination of RE systems, taking advantage of the probable Energy Act's feed-in tariff and renewable heat incentive, could replace 1,067 toe with green energy.

CARBON REDUCTION COMMITMENT

In July 2008 Defra wrote to 10,000 organisations that it believed use annually over 6,000 MWh electricity instructing them to submit their 2008 metre readings at the end of the year. If they have used 6,000 or more, they will mandatorily become part of the new UK Carbon Reduction Commitment (CRC) which is aimed at those heavy electricity users that currently fall outside the five heavy industries covered by the EU Emissions Trading Scheme. Defra estimates that the 10,000 CRC organisations account for 10% of the UK's CO2e emissions.

From 2010, the CRC organisations each year, for an initial three years, will have to buy EU Allowances (EUA) to match their 2008 emissions if they are to continue to use electricity at their metered 2008 rate. The EUAs will cost £12/tonne of CO2e. For example, an organisation such as a secondary school that used 6,600 MWh of electricity in 2008 will have to estimate how much

CO2e the generation of that electricity would have caused. In the UK, the average emissions per MWh are about 460 kg of CO2e. Therefore, the school would have emitted 3,036 tonnes of CO2e. It will have to pay a surcharge on its electricity of £12 x 3,036 = £36,432 per year for each of the initial three years from 2010. Thereafter, it is likely that the CRC organisations will become part of the EU Emissions Trading Scheme. If the school were to exceed its annual 3,036 purchased EUAs, it would have to buy more either at £12 each or on the open EU ETS market where they currently cost ~£15. However, if the school uses less electricity than it did either by efficiency or by switching to a green source of electricity, it will not only get refunded for its surplus EUAs but also be rewarded by a pro rata share of the money paid by other CRC organisations who had to purchase additional EUAs because they used more electricity than they had EUAs for.

From the table above, St Mabyn Parish will have saved 3,641 tonnes of CO2e which will have earned it 3,641 EUAs that it can sell in the open market for about £54,615. If all 200 Cornish parishes adopted the St Mabyn Greenprint, then the parishes would have sufficient surplus EUAs to sell, at today's price of £15/EUA, for £10.9 million pa.

While Defra has not published the list of the 10,000 organisations that it estimates use more than 6,000 MWh electricity pa, there are likely to be between 50 and 100 Cornish companies and organisations that will have to be part of the CRC scheme. It may be in their interests to invest in, or twin themselves, with a nearby parish especially if they can have direct use of some of the CHP that is generated.

CONCLUSION

Before parishes embark upon the parish Greenprint, they should identify nearby CRC organisations as it would be in the CRC organisation's best interests to invest in the Greenprint so as to reduce the CRC surcharge that they would otherwise have to pay.