Abergynolwyn – A study in transferable futility?.

Abergynolwyn, a compact community in Snowdonia was an early adopter of the concept of a community Biomass District Heating Scheme (BDHS). They were able to attract funding for project development work up to and including capital funding for the implementation of the scheme. As a condition of early grant aid they were required to offer a transferable "toolkit" for use by other communities. This essay is an attempt at a critique of the report with the aim of evaluating where possible it's portability to other communities and hence the wider implementation of BDHS's.

(Potter 2004)

The report covers in some detail the history of the project and gives an honest appraisal of the mistakes and difficulties encountered. I shall restrict my comments to matters which may adversely impact on the value of the reported methodology to other users. Whilst this may give a negative impression bear in mind that in almost all other respects the report is comprehensive, informative and the methods transferable. As a "toolkit" the report offers a commented history, a survey methodology and critique, a range of analysis of data, some conclusions from consultants reports and first blush costings of heat main and household wet systems. The report concludes with a step by step DIY guide for other communities.

History

The crucial aspect revealed in the history is the vital role of an expert champion resident in the community. In terms of replicability elsewhere it is almost certain such will not be available; but a paid worker with a regional energy agency or similar could fill the role. Severn Wye Energy Agency (successors to Powys EA) were unable to offer such support but could offer pointers to funding and short training sessions (2 days) for community groups. (Pers. Comm. 4.2.09) Similarly the participation of a potential ESCo from the start may not be available if the work load were to increase significantly. Second only to a champion is the involvement from the start of a credible organisation in the community; in this case the Village Hall Committee initiated the first approach to the ESCo. (1)

Whilst identifying early on that a community owned and led project was most likely to attract capital funding from EU derived sources the lead group also wanted a legal framework to separate themselves from legal and commercial risk; so on advice taken a Company limited by guarantee was formed, Cwmni Egni Abergynolwyn (CEA). At a later stage one potential funder reduced their support on the grounds that as a trading company they would be in direct competition with existing energy suppliers; notably the electricity distributor, and as such should not enjoy unfair support ! (Potter; pers. comm. 27.1.09) (2)

The Energy Audit.

The audit consisted of a questionnaire of householders followed by surveying typical building types and public buildings.(3)(Appendix a) Consultants then arrived at figures for total energy use which could be directly compared to data derived from the survey responses. A Further estimate of possible total energy use was derived from a calculation using published national averages. (Duncan 2003)(Appendix b)

Table 1 Comparison of energy use calculations

	Audit analysis	Averages	Annual spend
Total	**6,293,100**	**2,423,000**	**4,720,000**

The figures in the Audit analysis are as in the report and are derived from BRE software using data from the survey,(Potter 2004) The total figure for Averages is derived from the average household energy consumption (DTI 2001) per head.(4) This will be skewed by the extra use of energy in Abergynolwyn due to poor insulation compared to national average. Lack of time prevented trials using other estimating tools. The annual spend figure is derived from the survey returns. There is obviously no one single ball park tool applicable to the range of building types in a community like this.

The survey produced data on actual sources and costs of energy in terms of fuel bills; and on seasonal occupations and levels of installed insulation. Examination of these returns suggest that the expected total energy use figure given by the Audit analysis is above actual use. One implication of this is that if the existing households were given access to effectively constant heat they would increase their use up to an unquantified comfort level. This alone would seriously skew any attempt at a more precise energy use calculation; as would the effect of implementing energy saving measures as a first step.

The Engineers' report on Heat Main

A consultant engaged through Egni (Wales) Ltd. funded through CAE specified and priced the heat main. This was done by providing maps and local knowledge and observations on potential obstacles to two potential contractors along with a specification for the project. It is notable that the suppliers were asked to price for scenarios within load bounds of 4MW and 2MW (appendix c) confirms that the practicalities of plant and heat main sizing are within a different framework to the energy audit as conducted. The "toolkit" needs to make this clear to other potential users. On the other hand it is fair to say that as the actual boiler plant and operation would be contracted out to an ESCo, this falls entirely within their separate responsibility. Given this, the heat main still needs to be sized to carry the supply to everyone at peak demand. (5)

The two suppliers gave very different prices, with one significant difference in system specification, suggesting that oversight of the original specification they were given could have been improved. The draft report notes this issue. It transpired that one supplier was more experienced in distribution mains, the other in consumer connections. Consequently each had priced the other elements to cover greater risks inherent in either learning in place or using sub-contractors. (6)

An issue hinted at in an appendix to the toolkit, but not otherwise covered, is the maintenance and possible replacement of the heat main and how this is costed. Given that a plastic pipe solution has an expected service life of 50 years, does the price of a steel pipe system with a life of 20 years include 2 ½ times replacements to arrive at a price for equivalent life?(7) It may be argued that these matters come within the remit of the professional project manager who will be responsible to the community for delivery and at this stage may be introducing excess complications in terms of a transferable toolkit.

The final element of costing is the supply and fitting of consumer wet systems. These were done on the same basis as the energy use estimates, ie by a range of house types with specific surveys for the larger individual buildings. No single local contractor felt confident in taking on a job of this scale, but those asked reported they would be happy to act as sub-contractors to a larger prime contractor. (8)

Follow the money.

Attempting to follow up the funding sources for the Abergynolwyn BDHS revealed that all the programs and some of the organisations which nurtured them are defunct. Some have been replaced with more focussed schemes, some amalgamated into other projects, some simply no longer available. It must be said that at the time 2003-2005 there were considerable funds available for feasibility studies and development works with the aim of proving concepts in renewable energy within communities. The outcome was that funds were spent on a series of development studies and almost nothing actually got built. It is now unfashionable to fund such studies. (SNP CAE Officer Pers. Com. 4.2.09)

Table 2 ;Funding agencies most closely matching the original funders for Abergynolwyn (2004) as at Feb 2009.

Agency	Gwynedd European Partnership (exWEFO)	Snowdonia National Park (CAE)
Fund	Objective 1 Convergence	CAE
Total	open within national limits	<250k£ (varying)
Source	EU	WAG
Maximum award	45% of total	Level 1 to £1000 Level 2 to £34,999 Level 3 to limit available

Match requirement	Yes; non EU funds	Yes 25% non WAG
Exclusions	Must be strategic	*No feasibility studies*
Uptake	Competitive	Competitive 1:10
Usefulness level	Capital	Development

In addition two new agencies were identified who may be able to help a new project starting today. Severn Wye Energy Agency has absorbed some staff and functions from the defunct Powys Energy Agency. They were unable to offer grant help outside three specific target communities for existing funded projects; so not of general use. (SWEA staff member Pers Comm. 4.2.09). SWEA did indicate Environment Wales as a source of early development funding (http://www.environment-wales.org/grants)

The Community Action for Energy (CafE) project of the Energy Saving Trust offer a wide range of services on a free to user basis many of which may be relevant to a new community organisation initiating a BDHS. However they have no funds, nor any suitably qualified and experienced staff to hand hold groups through development work. They are able to direct users to potential sources of both according to their claim to have knowledge of expertise and funds. When I identified myself as a student I was told that CAfE as a charity was unable to assist academic studies, so I was unable to glean further information about their services. From the website it would appear at first blush that much of the help Abergynolwyn derived from Powys Energy agency and Green Heat could be replicated either by CAfE or via them by another agency. Using the CAfE website funding database with the search values “ Biomass+District Heating” gave no specific returns; as did District Heating alone. A similar search of their project database showed no results also. (CAfE website 5.2.09)

Ecodyfi (Pers. Comm. 5.2.09) report a capacity to provide some technical help to a community launching a BDHS today; but their funding and staffing are precarious. They would be unable to support a large number of projects simultaneously.

Overall it would seem that the funding situation is in fact no easier than five years ago, possibly even harder to obtain funding for vital development work such as planning applications and engineers specifications. As the latter are required for applications for capital funding this leaves many communities competing for the small total funds. For capital funding there is still EU funding, but again on a competitive basis and only for 45% of budget total; leaving a shortfall of 55% to be met elsewhere. (9) As the capital cost of a BDHS main is beyond realistic market funding only a scheme of capital grants from WAG and HMG. can be expected to deliver.

Conclusions

As a replicable toolkit the Abergynolwyn report gives a realistic picture of the scale and scope of the work involved. It would benefit from the following additions.

What is missing?

- The report would benefit from a work flow/time line (Gant Chart ?) showing the duration of tasks required, number of staff/volunteers, professional support and skill level at each stage.

- It should show both funding received and spent and funding applications which either failed or timed out. *Conditions* of grants should be spelled out.

- The energy audit fails to make clear that it only quantifies annual energy use rather than system loads; potentially misleading to non experts.

- Given additional resources, more could have been made of the data generated by the survey; perhaps enabling targeted energy saving works.

- It makes no comment on other potential solutions, such as a larger plant designed to generate electricity as well as provide heat.. This may be more important to larger communities.

- It makes no mention of security of fuel supply. Although this responsibility falls to the ESCo servicing the scheme it is crucial to the long term success; some consideration is required, particularly for sites with fewer local resources.(10) (Appendix e)

- A clear account of the various time scales of the life of the project, the system elements and it's contracts.

Clearly there is no single tool to estimate energy use in such a small varied community. It would be easy to be misled by spurious precision from using a single tool. The intention of leaving boiler supply and operations to an ESCo is strongly supported by this as the economics of boiler sizing depend on accurate user data. The replicability of the toolkit is fundamentally dependent on the availability of similar funding. In a world where even start up funds have to be competed for against other community schemes and implementation depends on ability to match what capital grants are on offer it would be wrong to offer hope that using this toolkit would lead directly to project success.

This critique is weakened by constraints of time. It would have been instructive to re-examine the returns from the household survey to extract further data on demographic influences on energy use. Similarly more detailed testing of other energy use models may have revealed one more useful, either by ease of use or quality of results. More time would have permitted an attempt to follow the money trail to WAG or HMG level to determine if in fact any centrally administered funds could be available to complement Objective 1 EU funds; if such exists, it is well hidden from practitioners in the field.

Appendices.

Appendix a; Example of compiled survey data; indicating level of detail used.

Bron-y-gader. 37
BUILDING DETAILS

Build type. Semi-detached
House age. 1966-76
Areas (external)
Ground floor. 59.76m2
Room heights
Ground floor. 2.6m
Number of rooms (inc hall) 6
Number of open chimneys. 1
House exposed perimeter. 22.7m

CONSTRUCTION DETAILS

Wall type. Cavity
Roof type. Pitched
Insulation
Loft. 75mm
Windows
Frames. Wood 67% uPVC 33%
Glazing. Single glazed 67% Double glazed 33%

HEATING DETAILS

Main heating. Storage heaters
Fuel. Off peak electricity
Secondary heating. Electric heaters
Water heating. On-Off peak electricity
Hot water tank. Normal with good jacket.

OCCUPANCY

One retired adult.

B&B. 12
BUILDING DETAILS

Build type. Detached
House age. Pre 1900
Areas (external)
Ground floor. 153.67m2
First floor. 153.67m2
Room heights
Ground floor. 3.4m
First floor. 2.88m
Number of rooms (inc hall) 17
Number of open chimneys. 2
House exposed perimeter. 49.6m

CONSTRUCTION DETAILS

Wall type. Stone
Roof type. Pitched
Insulation
Loft. 75mm
Windows
Frames. uPVC 65% Wood 35%
Glazing. Double glazing 65% single glazed 35%

HEATING DETAILS

Main heating. Boiler and radiators
Fuel. Oil
Secondary heating. Electric heaters
Fuel. Electricity On peak
Water heating. From main boiler + Immersion On peak
Hot water tank. Large with spray foam jacket.

OCCUPANCY

Four adults and two children in full time residency and then up to six guests on top.

(Potter 2004)

Appendix b; The consultants analysis of the survey data. (NB the box for *others total* has a typo and should read 1405640- final total not affected.)

INDIVIDUAL BREAKDOWNS.

NO.	CATEGORY	ENERGY USE KW/Hrs	No OF BUILDINGS	TOTAL ENERGY USE KW/Hrs
1	BRON-Y-GADER 11 Bron-y-gader 37	13111.1	16	209777.7
2	SMALL SLATE TERRACE 8 Tan-y-bryn St 89	36916.67	37	1365916.7
3	LARGE SLATE TERRACE 23 Water St 122	74583.33	22	1640833.2
4	LLANEGRYN STREET 12 Llanegryn St 157	16750	24	402000
5	SEMI DETACHED COUNCIL BUILT 7 Maes-y-mellion 19	10388.89	12	124666.68
6	BUNGALOW 2 Tan-y-fedew 52	36444.45	16	583111.2
7	BUNGALOW + ROOF ROOM Estimate	46888.89	5	234444.45
8	THE VILLAGE SHOP 133	65527.78	1	65527.78
9	THE VILLAGE SCHOOL 94	86083.34	1	86083.34
10	THE RAILWAY INN 173	86944.45	1	86944.45
11	THE B&B CWRT	91972.22	1	91972.22
12	OTHERS (Estimated on total average.)	35141.75	40	10405670
	TOTAL not including others			**4891277.4**
	TOTAL including others			**6329888.4**

(Potter 2004)

Appendix c; Load estimate using a spreadsheet and national average data.

DISTRICT HEATING LOAD

Introduction

This spreadsheet estimates the anticipated
- hot water heat load
- space heating heat load
- total heat load for a district heating scheme

for a specified size of community in the UK

Inputs

number of households	n_H =	136	number
number of persons per household	n_P =	2.45	number
annual energy consumed per household (as oil equivalent)	E_{TOT} =	1.988	tonne/yr
energy per litre oil	e_V =	9.640	kWh/Litre
fraction of energy for hot water (see Domestic Energy table below)	F_{HW} =	0.240	fraction
fraction of energy for space heating (see Domestic Energy table below)	F_{SH} =	0.580	fraction
density of oil	ρ =	0.882	kg/litre

Results

annual energy required from DHS	E_{DHS} =	2422733	kWh/yr
ave hourly energy required from DHS	e_{DHS} =	277	kWh/h

Calculations

total number persons	$N_P = n_H * n_P$	N_P =	333	number
energy consumed by community (as oil equiv)	$E_{COE} = n_H * E_{TOT}$	E_{COM} =	270.3	tonnes/yr
energy per kg of oil	$e_M = e_V / \rho$	e_M =	10.930	kWh/kg
energy consumed by community	$E_C = 1000 * E_{COE} * e_M$		2954588	kWh/yr
energy consumed for domestic hot water	$E_{HW} = F_{HW} * E_C$	E_{HW} =	709079	kWh/yr
energy consumed for space heating	$E_{SH} = F_{SH} * E_C$	E_{SH} =	1713654	kWh/yr
energy required from district heating system	$E_{DHS} = E_{HW} + E_{SH}$	E_{DHS} =	2422733	kWh/yr
ave hourly DHS	$e_{DHS} = E_{DHS} / (365*24)$	e_{DHS} =	276.6	kWh/h

Notes

1 Figures for energy from "UK Energy Statistics" published by DTI June 2001

2 Note that the ave power required per person is 0.83 kW
This provides a simple rule of thumb of 1kW per person all the time for a DHS

Breakdown of Domestic Energy 48,464,000 Tonnes Oil Equivalent

By Sector	%	Tonnes Oil Equivalent 10^6
Space Heating	58	28.11
Hot Water	24	11.63
Cooking	5	2.42
Lighting & Appliances	13	6.3
Total	100	48.46

Barney Duncan 2003. (As included on CD with Potter 2004)

Appendix d; Heat main estimates

Table 2. Summary of costs for 2 connection scenarios.

	Scenario 1. 94 house connections all indirect.		**Scenario 2.** 178 house connections all indirect.	
	Supplier 1	Supplier 2	Supplier 1	Supplier 2
2 MW capacity				
mains - supplier 2	1,004,530	456,763	1,004,530	456,763
service pipes - Supplier 2	1,297,500	390,854	1,297,500	732,741
Consumer interfaces - supplier 1	143,662	716,160	249,700	1,342,044
Total	**2,445,692**	**1,563,777**	**2,551,730**	**2,531,548**
4 MW capacity				
mains - supplier 2	1,043,930	572,919	1,043,930	572,919
service pipes - Supplier 2	1,297,500	402,348	1,297,500	754,506
Consumer interfaces - supplier 1	143,662	716,160	249,700	1,342,044
Total	**2,485,092**	**1,691,427**	**2,591,130**	**2,669,469**

Table 3. Summary results for 2 connection scenarios – re-totalled.

	Scenario 1. 94 house connections all indirect.	**Scenario 2.** 178 house connections all indirect.
2 MW capacity		
mains - supplier 2	456,763	456,763
service pipes - Supplier 2	390,854	732,741
Consumer interfaces - supplier 1	143,662	249,700
Total	**991,279**	**1,439,204**
4 MW capacity		
mains - supplier 2	572,919	572,919
service pipes - Supplier 2	402,348	754,506
Consumer interfaces - supplier 1	143,662	249,700
Total	**1,118,928**	**1,577,125**

(From Potter 2004)

Appendix e; Is there enough fuel?

Resource radii for different biomass plant size. The smallest is of interest.

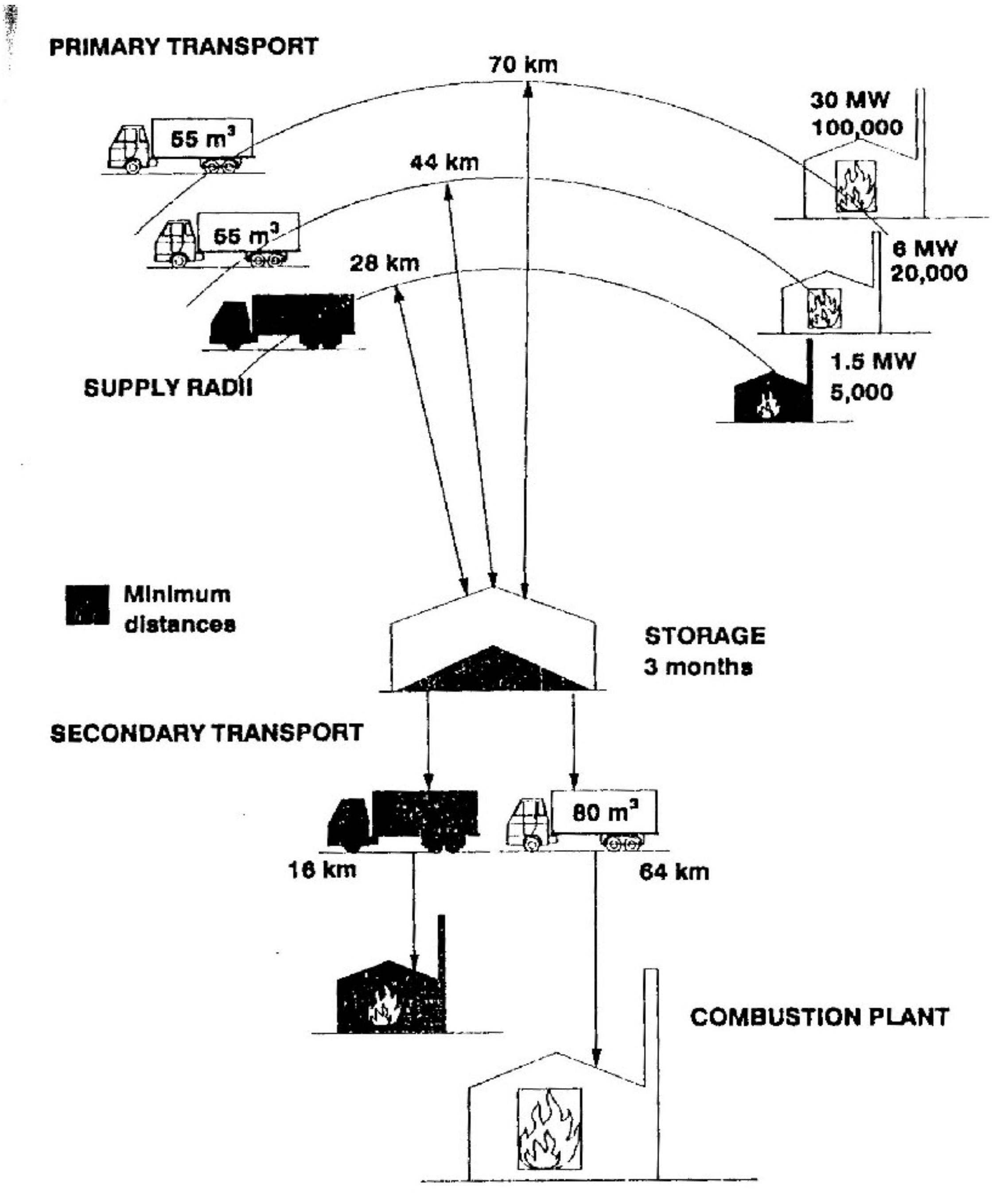
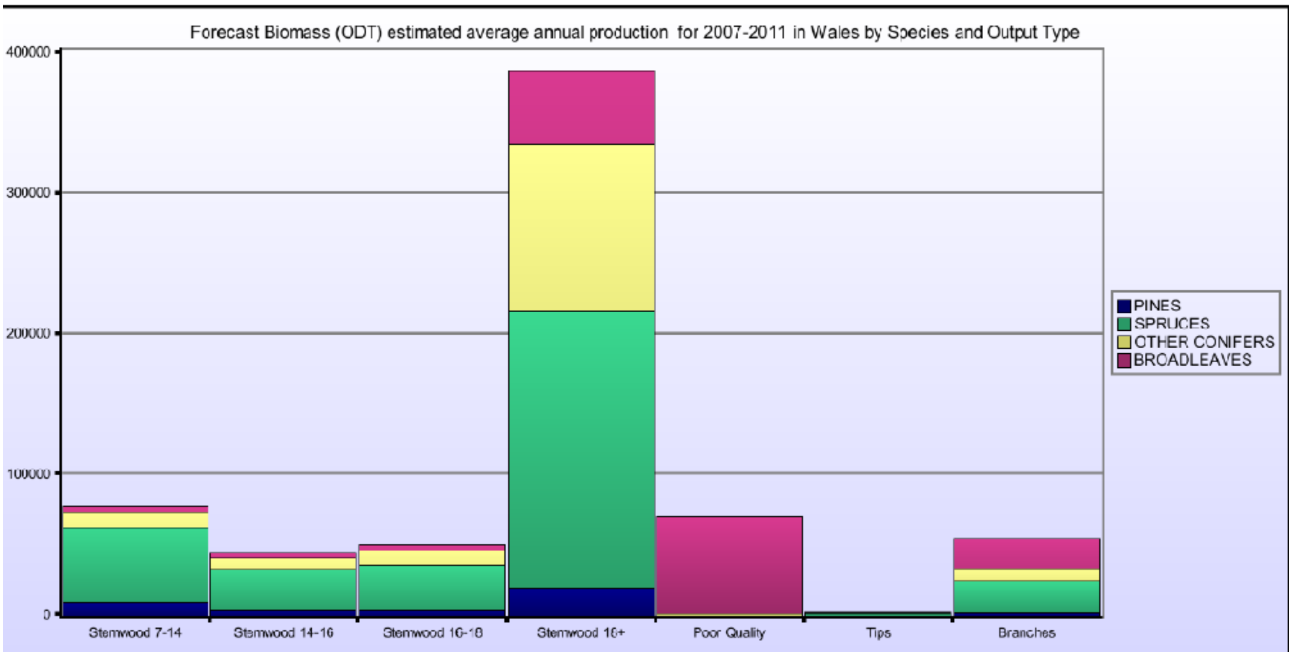


Figure 4. Combustion plant sizes and transport distances.

(From Hudson et al 1991)

This work needs to be redone to bring up to date values of total haulage cost compared with delivered fuel value. The real world resource radius will depend on the density of plantations and type of product used as fuel. There is also a potential issue in the longer term resulting from changes in forestry and land use policies as a “peak wood” moment approaches;

Forestry Commission and Private Sector Felling Biomass Forecast(Oven Dried Tonnes) estimated average annual production



http://www.eforestry.gov.uk/woodfuel/FGB.do

Appendix f; HMG policy and support mechanisms.

The impact of central policy and funding support has been examined and found wanting. Simply put, there is no realistic funding support available to implement biomass projects to bring about policy objectives. Van der Horst summarises;

The most recent objectives for the support of renewables were formulated for the Renewables Obligation (RO) which superseded the NFFO in 2001 (DTI, 2000):

1. To assist the UK to meet national and international targets for the reduction of emissions including greenhouse gases.

2. To help provide secure, diverse, sustainable and competitive energy supplies.

3. To stimulate the development of new technologies necessary to provide the basis for continuing growth of the contribution from renewables into the longer term.

4. To assist the UK renewables industry to become competitive in home and export markets and, in doing so, provide employment.

5. To make a contribution to rural development.

(Horst 2005)

These two graphs illustrate the difference between where we are supposed to be (for example like Austria, Denmark, Finland, etc.) and where we are now.

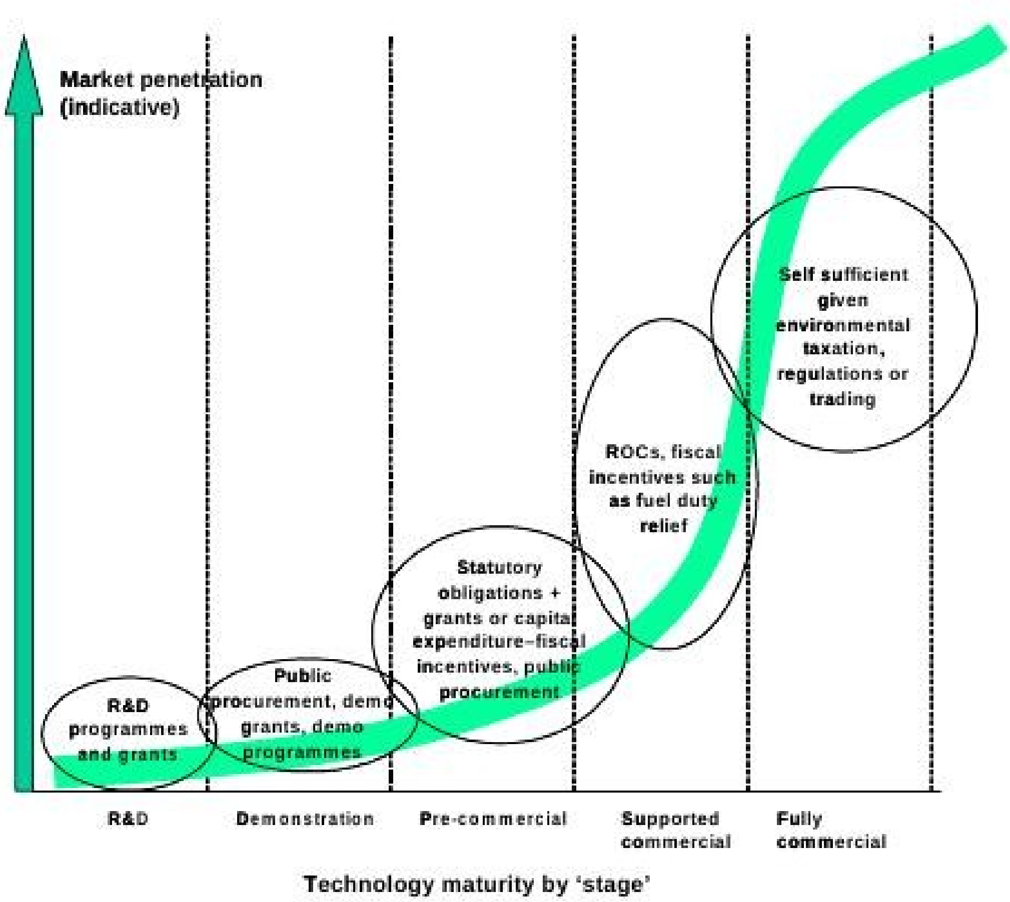
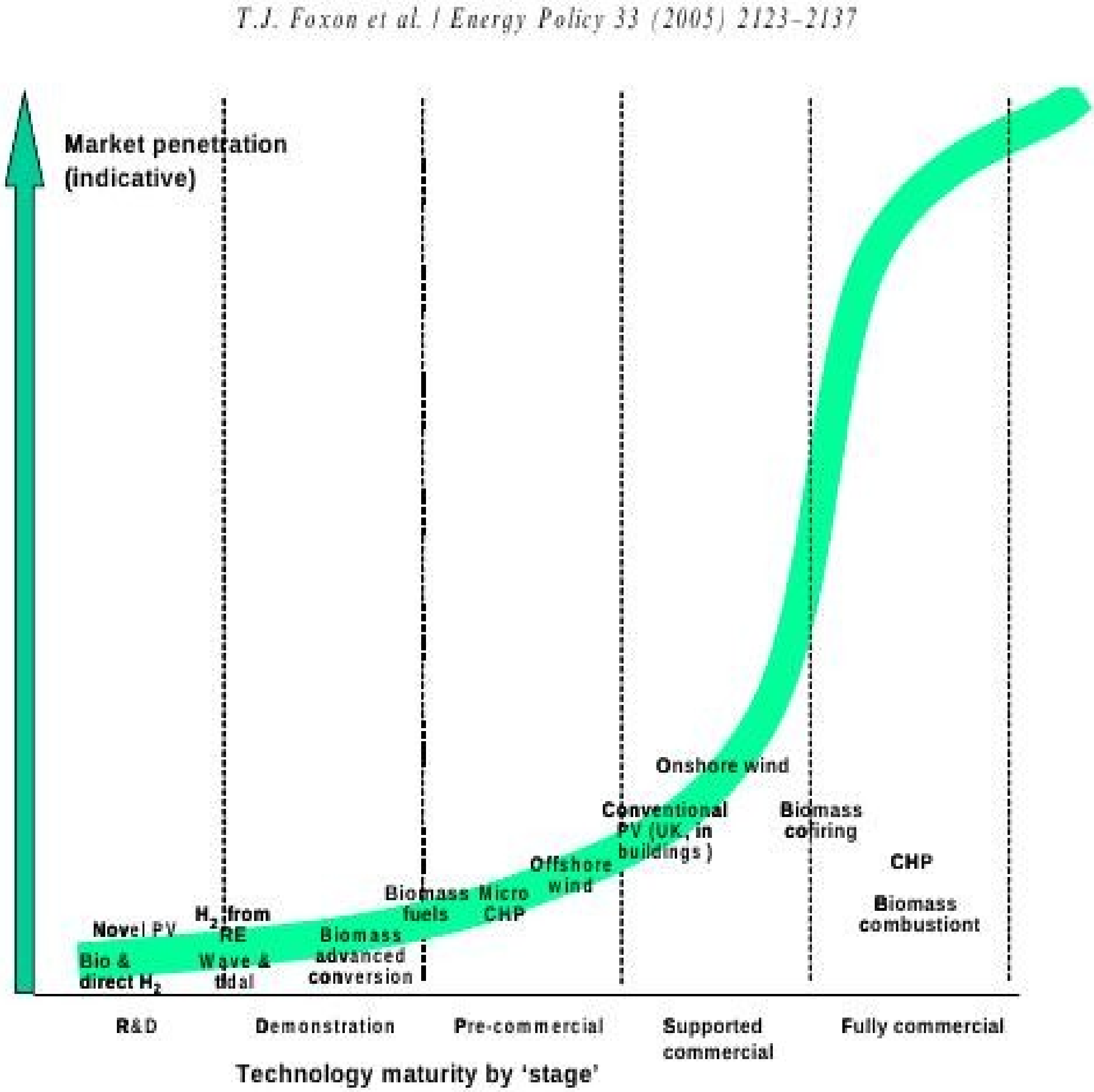


Fig. 4. S curve of technological development and policy instruments.



(Foxon et al 2005)

NOTES

1. Elsewhere this could be a Parish Council, school governors, any social or cultural group with a broad membership. This core group is crucial to the dissemination of support throughout the community, word of mouth being the most important means of transmission of ideas and news in small communities.

2. It appears that the core group should remain a non-incorporated voluntary body and that a trading company be formed only when needed for contract and risk management purposes, but note also that an incorporated community group may be needed to secure some types of funding. There is a need to identify the conditions specifically attached to any source of funding, and to ensure a range of bodies exist within the community to take advantage of these.

3. This can have other uses outwith a BDHS. An important aspect of this is social and demographic data which has a bearing on potential funding for the capital program. The data was gathered by a questionnaire distributed to all houses and site surveys of other buildings. The survey was designed to yield information about the buildings themselves, energy use and costs for heating and DHW, occupation patterns and demographic information. In addition, a field survey was carried out by walking the entire settlement comparing current maps with buildings on the ground with the aim of finding new buildings or cases of amalgamation. This potentially provides an accurate census of buildings in use. Coupled with actual returns this allowed the dwellings to be grouped into seven common types which could then be surveyed in detail. Public buildings were individually surveyed.

4. The data used were from the DTI "UK Energy statistics" June 2001 and are unlikely to have changed significantly in the intervening period. For any given community the input required is simply the number of households. There are reservations with this method. It takes no account of the demographic and occupancy issues arising in the specific community; (but it could with further development). It takes no account of the mix of building types and quality of insulation within the target community, which in Abergynolwyn and many other isolated Welsh communities is generally

poor. It does however provide an indicator of what could be expected were remedial measures to be applied *prior* to BDHS installation.

5. The estimates for the heat main include a separate costing for a main extension of 275m to the SW, to service 5 houses, costed at up to 30 k£ per house. This seriously begs the question of value for money compared to for example installation of a micro system dedicated to these houses. This is critically dependant on the delivered cost of the main. In other communities there is a risk of alienating households which be uneconomic to connect.

6. By combining the best value elements of each bid, with the support of both contractors it was possible to arrive at a much reduced price. It must be said that in the secret tender process often demanded by public funders this type of advantage may be lost, but that more potential suppliers could be asked to bid. At the time (2003/4) there were 5 firms in the UK advertising themselves as technically capable of this work. Bio-Energy Devices Ltd. (the engineers used) website gave a dead telephone number on 4.2.09 so I was unable to speak to them.

7. Another issue arising from plastic pipeworks is the quality of the connections; either as mechanical fittings subject to stresses from thermal expansion (may be trivial in practice) or by electro welding. If either type fails, then water may ingress into the insulation surrounding the feed and return pipes, effectively rendering it unserviceable as the water will drain away the heat. The heat main being the property of the community requires this failure mode to be an insured risk, which also needs costing. As one contractor was discussing using on the job trained local labour for this work this raises quality control and liability issues which are non-trivial. There is no value whatever in a warranty which imposes such a cost burden on the guarantor that they would prefer bankruptcy. In the wider context of this growing but young industry in the UK there is a supply chain issue in respect of sufficient skills for this type of work. There may be much we could learn (or buy in) from countries with a mature BDHS industry. One implication for policy at national level is the funding and certification of appropriate training and work in progress inspection and quality control as already exist for other utility services.

8. At this point it may be worth noting that the ball park figures given by Egni(Wales) Ltd. (Potter, pers. comm. 20.1.09) on first approach of 10 k£ per house heat main; 5k£ per house internals is remarkably close to the final detailed prices. Does this mean that the work implied in the detailed survey and estimation is wasted? It certainly must be done to satisfy potential funders but much of it is costly in consultant time *which itself requires funding*.

9. At present (Jan 09) capital funding for biomass projects is offered through the DECC in England at 40 % of capital cost above the cost of same capacity fossil fuel plant with a base line of £40/kW for fossil fuel plant. There are some rigorous conditions including the security of fuel supply and quality and a requirement for proof of reliability of plant. The criteria for funding could be interpreted to include heat main (but is not explicitly mentioned as such); issues could arise in deciding what are equivalent installations. The maximum grant is k£500. There are other conditions relating to sourcing of other funds so as to encourage private sector money into schemes. Whilst this may be viable for an ESCO to fund boiler plant, there is no present hope of it applying to BDHS.(DECC website Jan.09)

10. Two matters arise. Firstly, is there enough fuel sustainably available in reach of the site.? The basic work on sustainable resource radii has been done (Hudson et al. 1991 and appendix e) Which suggests that Abergynolywn is vulnerable if biomass is adopted by larger towns in the area. The second matter is the wider adoption of biomass and other uses of the forest resource, leading to price inflation. The Countryside Land and Business Association issued an advice note to members on negotiating supply contracts which suggests medium term rather than long term commitments. (Harwood & Starkey 2001). Perhaps communities should look to owning the resource themselves?

References

CAfE 2009;

Community Action for Energy; www.energysavingtrust/cafe/Community-Action-for-Energy/How-we-help/Funding-Advice/CAfE-Funding-Database

DECC 2009.

Department for Energy and Climate Change. www.DECC.gov.uk

DUNCAN, B. (2003);

"*District Heating Load*"; Spreadsheet on CD offered with Potter 2004 (Abergynolwyn report).

HARWOOD, O.,STARKEY, N.,(2001),

Country Land and Business Association. Guidance note GN 25/02 Energy Crops Drafting a Supply Contract: Checklist for agreements. Country Land and Business Association; www.cla.org.uk

HUDSON,J.B., MITCHEL, C.P., STORRY, P.G.S., (1991)

"Fuelwood Production Systems"*. Proceedings of Discussion Meeting April 1991 Wood for Energy: The Implications for Harvesting, Utilisation and* Marketing. Heriot-Watt University, Edinburgh 5-7 April 1991. Ed. Aldhous, J.R; Institute of Chartered Foresters 1991.pp 90-111. ISBN 0 907284 14 0

FOXON, T.J, GROSS, R., CHASE, A., HOWES, J., ARNALL, A., ANDERSON, D.;

"UK Innovation systems for new and renewable energy technologies: drivers, barriers and systems failures." *Energy Policy* **33,** 2005, pp2123-2137.

Downloaded from www.elsevier.com/locate/enpol.

POTTER,P.;(2004)

The Abergynolwyn Community Energy Survey and Methodology; Abergynolwyn, Cwmni Egni Abergynolwyn (Contact Jones,R. 7 Maes y Meillion, Abergynolwyn, Tywyn, Gwynedd, LL36 9YF.) Not available online as at 5.2.09.

Van der HORST, D.
"UK Biomass energy since 1990: the mismatch between project types and policy objectives." *Energy Policy* **33 ,**2005, pp 705-716.
Dowloaded from www.elsevier.com/locate/enpol.