Woodfuel in the East of England

Prospects and Potential

with special reference to the Norfolk & Suffolk Rural Priority Areas

Client:

East of England Development Agency; Forestry Commission East of England Conservancy; Countryside Agency East of England Region

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INTRODUCTION

This report sets out the results of work undertaken to assess the potential for the development and growth of the wood energy industry in the East of England (with particular reference to the RPA's). The report examines existing and potential markets and seeks to identify the main opportunities for growth in the sector. In addition, market barriers that constrain growth are identified and actions to overcome them set out in an Action Plan that identifies where resources can be focussed to most effectively assist the development of the wood energy sector in the region.

Why wood ?

The use of wood for energy brings with it a raft of potential benefits that cut across many different strands and may be said to offer a model of *sustainable development*:

1. Woodfuel is 'carbon neutral'.
2. Woodfuel is a competitive source of energy compared to most fossil fuels such as oil, and even natural gas, and energy from woodfuel used for heating is *the* lowest cost of all renewable energy technologies.
3. Woodfuel sourced from local woodlands can be a powerful stimulus for bringing neglected woodland back into management, which would in turn bring a range of benefits, including: income generation for owners, contractors and suppliers; employment and job creation; improved woodland quality; improved habitat value and biodiversity; enhanced value for sporting and other amenity uses.
4. Finally, although not the focus of this report[1], SRC does have the potential to offer an important diversification opportunity for farmers, and the use of clean woody wastes for energy also offers a route for reducing waste disposal costs and pressure on landfill.

These benefits offer a potential 'win-win-win' situation for all involved, be it the landowner, contractor, end-user or the public at large. A combination of a newly favourable fiscal and regulatory environment and rising market prices for oil and gas has created an opportunity for significant market growth in the UK. However, the industry is still in its very earliest days and a

[1] Note: the primary focus of the report is on the opportunity offered by the developing wood energy market for the woodland / forestry sector. Undoubted opportunities also exist relating to recovered woody biomass, to energy crops and to pellets, and they are indeed touched on, particularly in the Action Plan, but they entail in many ways quite different drivers and are not considered in detail.

number of market barriers still exist that must be overcome if this growth potential is to be achieved and the benefits realised.

POLICY BACKGROUND

The first main section of the report considers the main policy drivers that provide the context for the development of wood energy for heating, CHP and electricity generation. Essentially these come down to two converging elements, with the synergy between them providing an important opportunity for the Region. These are:

1. Climate Change and renewable energy policy. The UK is firmly committed both to 20% reductions in CO_2 emissions from 1990 levels by 2010 and to 10% renewables within the same time frame. To achieve these goals, a comprehensive framework of fiscal and regulatory instruments is now in place and has already begun to produce rapid deployment of RE electricity generating capacity in a number of technologies. UK renewables policy is also now being translated into regional policy, and target of 14% renewable energy by 2010 is emerging from work led by GO-East (although not yet formally in place).

2. Rural development policy, especially relating to diversification of land-based enterprises (forestry and agtriculture). Both are suffering from extremely difficult market conditions at the present time, with the extent of the downturn in both sectors being such that the viability of many existing businesses is threatened and significant restructuring is already underway. Again, this is a regional as well as a UK-wide issue, and is strongly reflected in both regional and more local policy, for example at the level of EEDA (whose corporate plan makes specific reference to *supporting strategic action to develop biomass energy production*) and of the county *Rural Development Programme Strategies* (RDP's) in Norfolk and Suffolk.

THE WOODLAND SECTOR IN THE EAST OF ENGLAND

The next section of the report seeks to provide a context for considering wood energy by examining the woodland / forestry resource, which is both significant and currently substantially under utilised. Total woodland coverage is 139,112 ha (7.3% of the land area), an increase from 5.8% in 1980. This includes 113,094 ha of woodland in 7,767 blocks of 2 ha or more, each with an average size of 14.6 ha. The predominant forest type is broadleaved woodland, accounting for over half of all woodland (55.6%), and although the main public sector estate managed by Forest Enterprise is substantial, 77% of the woodland area is privately managed (87,392ha). Broadly speaking, this private estate is characterised by smaller, predominantly broadleaved woodlands (average size 11.3 ha, 68% broadleaved across the region), the FE estate by larger, predominantly conifer woodlands (average size 231 ha, 70.6% conifer across the region).

These existing areas of woodland make a very important contribution to the 'wealth' region in terms of:

- biodiversity and landscape diversity
- social amenity value, including sporting value
- timber value, jobs and so-on

However, the current financial climate in the sector is re-enforcing a longer-term neglect, so that of the total woodland estate it is estimated that as much as half, or >40,000 ha in Norfolk and Suffolk alone, is largely unmanaged. *All* of this woodland is in the private sector, ie. perhaps 80% or more of the private woodlands are undermanaged. Over time, one result of this neglect is a significant decline in the quality of standing material, which then produces a self-reinforcing trend:- reduced quality ► reduced value ► further neglect ► further reduction in quality and so-on.

In this context, two potentially key benefits of the woodfuel sector is that it is a) local (unlike the pulp mills) and b) able to deal with relatively low-grade material. It therefore has the potential to act as the catalyst for the re-introduction of positive management into the large under-managed estate. Although very much an indicative figure, the estimated sustainable productive capacity of small roundwood for the region (an indicative benchmark for woodfuel production) is approximately 205,000 tonnes per annum (with a substantial back-log of additional, accumulated material available in the short-term). The development of large-scale (multi-megawatt) electricity generation plants would rapidly put pressure on this resource. However, in the context of smaller-scale developments of wood heating, or possibly CHP, the resource *per se* is not likely to be limiting in the short-medium term, even allowing for relatively rapid growth (with energy crops having a more important role in the longer-term.

THE MARKET OPPORTUNITY

The final main section considers both the market opportunity and some of the remaining constraints on development, which are used to inform the Action Plan that forms the final section of the report.

Sticks and carrots

The raft of strategy papers and consultations have now resulted in a positive policy framework and concrete fiscal and regulatory mechanisms to promote low carbon technologies, RE technologies and biomass in particular. This relatively complicated web of measures effectively provides the driver for market development in the UK and includes:

- the Climate Change Levy;
- the Renewables Obligation;
- Enhanced Capital Allowances;
- the UK Emissions Trading Scheme;
- the Bio-energy Capital Grant Scheme);
- the Bio-energy Infrastructure Scheme;
- the Community and Household Capital Grants Scheme (*Clear Skies*);
- the Energy Crops Scheme;
- R&D programmes and other measures (eg. to support community heating).

Although the number of measures, themes and priorities can become confusing, overall the fiscal and regulatory environment for the development of biomass, including woodfuel, is extremely positive. Challenges remain, and there is no doubt that the role of the regions in helping to translate the raft of national policies and measures into local action is potentially pivotal, something that is elaborated in the Action Plan.

The opportunity

For the next several years, the largest market in the East of England will remain the demand for woodfuel created by the FibroThetford electricity generating plant. However, while the importance of FibroThetford should not be diminished, it is nevertheless the case that this 'bulk' woodfuel market draws on a relatively limited catchment and is likely to remain relatively static in the Region for the medium term at least. In contrast, the development of smaller scale, localised wood heating plants such as that at the EcoTech Centre in Swaffham holds out the potential for very substantial growth, with additional potential for Combined Heat and Power (CHP) in appropriate circumstances.

It is certainly the case that in those European countries where energy from wood is already integrated into the energy supply infrastructure, the largest proportion of woodfuel is used to generate heat. Indeed, countries including Denmark, Sweden, Finland, Austria, Germany, France and Switzerland have generally followed a well-rehearsed path:

The development of wood energy in continental Europe:

Traditional use of woodfuel (logs) in individual houses →

→ improved boilers for households, including introduction of wood-chip boilers →

→ development of localised community heating or district heating networks served form central boilerhouses with wood-chip boiler plant; development of CHP in large process applications (particularly paper mills and similar) →

→ CHP added to district heating networks (still rare) →

→ stand-alone electricity generation and / or co-firing considered (still extremely rare) →

→ advanced conversion technologies (gasification, pyrolysis) considered for large-scale stand-alone generation (none operating commercially in Europe).

Thus it is that wood <u>heating</u> rather than electricity production or even CHP accounts for almost half of all renewable energy production in the EU. While the size and fuel requirement of individual heating plants are substantially less than for electricity generating plant, projects of this kind are far more readily achievable and can be realised over a much shorter time frame, and for the first time in the UK the opportunity properly exists to create a 'bottom-up' woodfuel industry which can mature rather more naturally.

Indeed, the market for heating and process fuels is actually larger than that for electricity in the UK, accounting for approximately 45% of total energy use. Moreover, woodfuelled heating is probably *the* lowest cost of all renewables both in terms of capital intensity / capital cost and in terms of delivered energy costs.

Fuel type	Fuel price	Units	Fuel price p/kWh	Saving p/kWh
Wood @ 35% mc (equiv £23/t @ 50% mc)	30.00	£/tonne	0.91	n/a
Heating oil	18.5	p/litre	1.90	0.99
Natural gas (commercial)	1.25	p/kWh	1.25	0.34
Natural gas (domestic)	1.7	p/kWh	1.7	0.79
Tanked gas	20.0	p/kg	2.32	1.41
MFO	13.5	p/litre	1.27	0.36
Coal	55.00	£/tonne	0.86	-0.05
Electricity (off peak domestic)	3.0	p/kWh	3.00	2.01
Electricity (peak domestic)	6.0	p/KWh	6.00	5.01

Table EX.1: Woodfuel equivalent energy costs compared to fossil fuels

Target markets

There is no doubt that the relatively low cost of natural gas, particularly for non-domestic consumers, makes it difficult for woodfuelled heating to compete in many circumstances and the low cost, widespread availability and relative ease of use of natural gas are probably the largest single constraint on uptake of woodfuelled heating. However, in rural areas the gas network is far from comprehensive - a survey of parish councils in the Norfolk RPA found that over 90% of respondents had no access to natural gas, something that is by no means confined to the RPA. In such rural or rural-fringe areas, where consumers tend to be reliant on oil, lpg or, in a domestic context, electricity for their heating needs, there are a wide diversity of potential end-users for whom woodfuelled heating can be cost-effective, including:

- process heat users, including food processors
- horticulture (glasshouses)
- community heating, primarily in new-build developments
- higher education campuses
- armed forces bases, prisons
- hospitals and nursing / care homes
- leisure centres
- retail complexes, distribution centres
- hotels
- schools
- rural estates and farms

Market barriers

Clearly, there are inevitable challenges entailed in offering energy that is not only renewable but also competitive in the wider energy market. However, with current fossil fuel costs set only to rise in the medium-term, there are also undoubted opportunities. Thus, in combination with the positive fiscal and regulatory framework that is now in place, market conditions for the development of woodfuelled heating in the UK are now better than ever before and the scene has undoubtedly been set for substantial growth that could develop over a relatively short timespan.

However, a number of market barriers continue to inhibit development at the present time:

1. Undeveloped markets, both public and private sector.
2. Lack of fuel supply infrastructure.
3. Lack of awareness on the part of end-users and specifiers.
4. Lack of technical expertise in the form of those qualified to specify and install heating systems.
5. High initial cost of wood boiler plant.

Dealing with these issues will be critical to establishing a viable wood heating sector that is able to develop and grow, and there is certainly a key role to play for innovative approaches, such as that offered by *Energy Service Companies* (ESCo's) or *Heat Entrepreneurs.* In addition, it is significant that many can be addressed at a regional or even sub-regional level.

ACTION PLAN

Consideration of the market, and specifically of potential constraints to market development, draws out the need for a number of actions in order to further develop woodfuel in the East of England. These are consolidated into an Action Plan in the final section of the report that is reproduced as a whole below:

Actors and stakeholders

i. This strategy should be formally adopted across key organisations. These include the current funders and, with it's region-wide strategic overview, the Government Office (GOER).

ii. The strategy should be disseminated to other stakeholders – local authorities and other public sector, Community Forests, the CRI, Rural Community Councils and so-on, including also the private sector - making clear the commitment to implement it. The positive engagement of these stakeholders is essential to success.

iii. As indicated above, action must be both concerted and co-ordinated if it is to be successful, and it is almost certain this will require that a lead agency takes on the role of 'regional advocate'. Based on its immediate and particular concern with the woodland sector, it is suggested that this would most obviously be filled by the Forestry Commission, a role that is already beginning to emerge in regions such as the East and West Midlands and in the South East.

iv. Alongside the role of a regional advocate, serious consideration should also be given to resourcing a dedicated and autonomous networking, co-ordination and mentoring function comparable, for example, to the Advantage West Midlands funded *Marches Wood Energy Network* (MWEN) in the West Midlands.

Principles

i. To be effective, it is important that all of the market barriers identified should be tackled in a concerted fashion - an *ad hoc* or poorly co-ordinated approach is simply unlikely to be effective.

ii. Build on the strengths that the Region undoubtedly has: an existing fuel supply infrastructure to supply FibroThetford and existing fuel supply contractors (MI Edwards and Econergy Ltd); a pioneering wood-energy ESCo, one of perhaps only three such companies in the UK and a tremendous source of local expertise (Econergy Ltd); a fledgling SRC *producer group* (Anglia EnCrops).

iii. Use existing demonstrations and develop further 'exemplars'. Already the wood boiler at the EcoTech Centre in Norfolk is used regularly in connection with promotional activities and it has an invaluable role in this regard. In contrast, the installation at Marston Vale is disastrous and should be rectified. While this will involve significant re-investment it could then provide a second, geographically distinct resource similar to EcoTech. Although there is a limit to the number of 'demonstrations' that are credible without a wider level of activity, further strategic 'exemplars' should also be identified and supported to give a diversity of geographical coverage and also of applications. The proposal to include a wood boiler at the new Thames Chase visitor centre should certainly be supported.

iv. Build on experience and lessons learned elsewhere in the UK & Europe . It is arguable that the UK woodfuel industry has battled for more than a decade to achieve a model of development based around large, central electricity generation plant that is fundamentally difficult to achieve, and success has indeed been very limited at the time of writing. In contract, the use of woodfuel, primarily for heating, is an absolutely standard part of the energy mix across much of Europe, and countries such as Austria have shown how effective carefully worked through public sector support can be in stimulating both innovation and growth.

v. Focus on the easy, low risk things that can quickly make a difference to installed capacity and, thereby, to both awareness and confidence. By way of example, it would be relatively straightforward to 'seed' a number of 'self-supply' clusters with simple and achievable on-farm applications. In contrast, planning for large-scale community heating networks in new developments such as Elstow should certainly be pushed hard, but will take many years to come to fruition and must be kept in perspective. Similarly, waiting for a 'kick-start' from a power station at Eye, Corby or elsewhere has the potential simply to run into the sand and come to nothing.

Actions

Promotion and marketing

- Promote wood energy across the region to raise its profile via targeted PR and promotional events; facilitate networking.
- Focus marketing on the 'early adopters' - the public sector, the *Carbon Market*, *self-supply* farms, estates etc, the waste wood and wood processing industries - and on priority areas, particularly the RPA's.

Technical development and technical support

- Effectively signpost reliable sources of information and advice; support provision of such advice, for example by providing funding for the development of resource material (case studies, guidelines and so-on) and for feasibility / development studies.
- Target specifiers, for example via a CPD programme.
- Encourage diversification of a core of existing heating engineers / installers by providing focused training opportunities.
- Foster expertise within new ESCO's and HE's to ensure that they are able to provide an effective service.
- Work to improve fuel supply chain development – technical developments and information flows.

Initial deployment

- Use 'pioneer sites' to foster clusters of sites and local critical mass, for example in the RPA's and Community Forests; public sector managers should be strongly encouraged and assisted to consider woodfuelled heating as a viable option to create some such pioneers.
- Offer support to ESCO's and HE's, acknowledging the key role they are likely to play in achieving market penetration.
- Ensure that the national grant schemes are effectively promoted and consider providing additional capital support for both boiler plant and fuel supply infrastructure via regional grant aid targeted at pioneer sites and clusters.
- Use the demand created by live projects to drive supply chain development by creating 'market pull'; seek also to facilitate supply chain development from private sector woodlands into the FibroThetford power station; acknowledge the role of waste wood in pump-priming the industry in some circumstances and also the long-term role of energy crops by fostering the nascent regional producer group, Anglia EnCrops.

Most of the above can be put into effect relatively quickly, and if implemented effectively they will have a substantive impact in the short to medium term (by 2005). At the same time, they will provide the critical mass that is needed to see sustained growth into future, when pioneers and clusters focused on priority areas such as the RPA's can expand to create a diversified and more broadly-based woodfuel industry in the Region.

The funding provided for this work by the following partners is gratefully acknowledged:
EEDA (Rural Development Programme)
The Countryside Agency
The Forestry Commission

1. INTRODUCTION TO THE STUDY

This report sets out the results of work undertaken to assess the potential for the development and growth of the wood energy industry in the East of England. The report examines existing and potential markets and seeks to identify the main opportunities for growth in the sector. In addition, market barriers that constrain growth are identified and actions to overcome them set out in an Action Plan that identifies where resources can be focussed to most effectively assist the development of the wood energy sector in the region.

Note: particular reference is made to the Norfolk and Suffolk Rural Priority Areas (RPA's). These predominantly rural and agricultural areas have all the attendant problems associated with access to jobs, training and services, social isolation and deprivation, and have therefore been the focus of regeneration funding since 1994. In particular, they are eligible for grant aid from the East of England Development Agency (EEDA) to develop a wide range of economic, environmental and social projects in line with the Regional Economic Strategy and the Rural Development Programme Strategies (RDP's) for each of the Counties.

Financial support from this source has substantially funded this report specifically because of the fit between the opportunities offered by woodfuel development and the needs of the RPA's. However, the RPA's as currently cast will cease to exist from April 2003. From this time, the strict boundaries that apply at present will be removed, with effort instead being focused on the areas of greatest deprivation. In practice, this means that most, if not all, of the parishes that currently constitute the RPA's will continue to receive priority, but that eligibility for support will be rather wider and in some degree 'fuzzier'.

For the purposes of this report, therefore, reference is made to the RPA's, which still exist at the time of writing. However, post April 2003 such references should be taken to refer to the more widely cast indices of deprivation that will determine eligibility for support under the RDP's from thereon.

In addition, most of the issues covered are by definition rather more widely drawn anyway, so that much of the report of necessity refers to the region as a whole, within which wider context the RPA's must be viewed. Nevertheless, specific actions relating to the RPA's are drawn out in the Action Plan in order properly to reflect the importance accorded to them.

Particular reference is also made to the three Community Forests in the region, which have a potential role in pioneering and demonstrating wood energy applications not only within their core patches but in the region as a whole.

1.1. *Focus of the report*

The primary focus of the report is on the opportunity offered by the developing wood energy market for the woodland / forestry sector. Undoubted opportunities also exist relating to recovered woody biomass, to energy crops and to pellets, and they are indeed touched on, particularly in the Action Plan. However, they are not considered in detail for the following reasons:

- Clean recovered woody biomass (arboricultural arisings, joinery waste, pallets etc)[2] - while this material undoubtedly has a role to play in the emerging biomass industry, it essentially represents an entirely separate, parallel supply chain from forestry material or energy crops. It also has a substantially different set of drivers (Landfill Directive, Landfill Tax, Package Recovery Notes (PRN's) etc) and has only limited relevance to providing diversification opportunities within the rural economy, one of the main drivers for the work herein.
- Woody energy crops (primarily *Short Rotation Coppice / SRC*) - the principal role of SRC is in providing an expanded and dedicated biomass resource in the context of large electricity generation projects. Within such a context, SRC has an undoubted role to play in providing a diversification opportunity for conventional farmers, and a fledgling *producer group*, Anglia EnCrops, does indeed exist within the region. However, while this is referred to in Section 4.2 (footnote 51), much of the report focuses on the particular opportunity represented by smaller scale heating projects. In this context, the existing woodland / forestry resource has sufficient capacity to meet the likely level of demand for the foreseeable future, even if allowance is made for rapid growth.

  In addition, the only viable supply chain for SRC, ie. one-pass 'cut and chip' harvesting, can present challenges for heating applications, particularly in relation to storage of harvested material (forestry material can be stored 'in the round'). It is quite possible that in a more mature woodfuel market SRC growers whose primary customers are larger generating plants will indeed supply material to heat users. However, in the medium-term

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[2] Excluded from this are 'contaminated' woody wastes that would fall under the Waste Incineration Directive (WID). Although the definition of waste can be a notoriously grey area, the draft WID specifically excludes *vegetable waste from agriculture and forestry* and *wood waste*, <u>other than</u>:

- wastes that may contain halogenated organic compounds or heavy metals as a result of treatment;
- treated wood originating from building and demolition waste.

at least it is relatively unlikely that SRC will be established specifically to supply heat plant in the first instance[3].

- Pellets - pellets are potentially an ideal fuel for small-scale automated wood heating boilers suitable for individual households. For this reason, they will almost certainly play a role in achieving market penetration into the domestic sector in the longer term. However, at the present time pellets are at a very early stage of development in the UK, with just one small-scale producer of woodfuel grade pellets in County Durham[4]. Capacity will develop in time, but for the moment the only source of pellets are generally ***ad hoc*** imports brought into the UK in relatively small batches. With no established agents or distribution network in the East of England it is not practicable to install pellet appliances at the present time. Moreover, the feedstock for pellet manufacture is almost universally sawdust and other waste products, and in this sense even if UK or locally produced they are of no direct relevance to forestry or agricultural diversification. Thus, while it is important to maintain a 'watching brief', they are not considered further in the body of this report.

1.2. Note regarding firewood

Although not considered in this report, the role of the firewood market must also be recognised. A recent Intermark Study (updating a 1994 study)[5] confirms that firewood logs remain a major product for the region's woodland economy. The total value of sales through Garden Centres, DIY Sheds, Garage Forecourts and Farm Shops have been growing at c.6% per annum and were worth c. £5,037,000 in 2001 (almost entirely via garage forecourts).

In parallel, a side-study conducted as part of the Regional *Woodland Wealth Appraisal*[6] looked at small-scale operators in NE Suffolk and NW Norfolk. This found that most sales were to households, for supplementary / amenity heating – only 5% of sales were to households using wood as their major source of heat. Most of the sector operates on a small-scale, part-

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[3] It is the author's opinion that the UK needs to develop single stem energy crop models alongside SRC (sometimes referred to as *Short Rotation Forestry* or *SRF*) for the longer term. Such a model would be far better suited to heating applications, and work has indeed been done on single stem poplar in this regard (and birch and other natives such as ash, hornbeam and others might also be looked at, as might 'exotics' such as eucalyptus). However, at the present time, SRF for energy is not supported by any of the grant schemes (Energy Crops Scheme, WGS or FWPS) and is effectively therefore unviable.

[4] Premier Waste Ltd, who produce pellets from the fines fraction of a wood waste recycling operation.

[5] Firewood, fencing & furniture in the East of England, Forestry Commission 2002, www.forestry.gov.uk/forestry/INFD-5F2LGS

[6] Draft Executive Summary presented at a Launch Conference, Duxford December 2002.

time basis. The study also estimated that perhaps 60,000t of firewood are produced for sale per annum in the region.

1.3. Why wood - people, economy, environment

The use of wood for energy brings with it a raft of potential benefits that cut across many different strands and may be said to offer a model of *sustainable development*:

4. Woodfuel is 'carbon neutral' (see Section 2.1 below) and renewable, leading to reductions in emissions of CO_2 by offsetting the use of fossil fuels. Development of wood energy applications therefore contributes to meeting emissions reductions targets and renewables targets.

5. Woodfuel is a competitive source of energy compared to most fossil fuels such as oil, and even natural gas, and energy from woodfuel used for <u>heating</u> is *the* lowest cost of all renewable energy technologies. It therefore has the potential to offer end-users affordable energy at prices that can also in some degree be insulated from predicted increases in fossil fuel prices. This is particularly so in rural or urban fringe areas where natural gas is often unavailable. In addition, moneys spent on woodfuel are almost by definition spent locally and so are retained within the rural economy and even, in the context of 'self-supply', within individual rural businesses.

6. Woodfuel sourced from local woodlands can be a powerful stimulus for bringing neglected woodland back into management. The East of England as a whole has a huge under utilised woodland / forestry resource and re-introduction of positive management stimulated by 'demand pull' from a growing wood energy industry would in turn bring a range of benefits, including:
   - income generation for owners, contractors and suppliers
   - employment and job creation
   - improved woodland quality in terms of both future productivity and enhanced asset values
   - improved woodland quality in terms of habitat value and biodiversity
   - enhanced value for sporting and other amenity uses, including improved access (unmanaged woodlands are often impenetrable and inhospitable)

4. Finally, although not the focus of this report, SRC does have the potential to offer an important diversification opportunity for farmers, and the use of clean woody wastes for energy also offers a route for reducing waste disposal costs and pressure on landfill.

These benefits offer a potential 'win-win-win' situation for all involved, be it the landowner, contractor, end-user or the public at large. A combination of a newly favourable fiscal and regulatory environment and rising market prices for oil and gas has created an opportunity for significant market growth in the UK. However, the industry is still in its very earliest days and a number of market barriers still exist that must be overcome if this growth potential is to be achieved and the benefits realised.

In this context, the primary aim of this report is to assist in the development of a strategic approach at a regional level, with a particular emphasis on channelling effort into the RPAs. While intended to be useful to a wide range of users, including contractors, land-owers and potential end-users, it is particularly aimed at policy makers and strategic authorities to assist in formulating such an approach, and it therefore concludes with a summary Action Plan. In this sense, the study is to be seen as the first stage in a longer-term process which will require a concerted and effectively co-ordinated effort aimed at substantially boosting both the profile and the use of woodfuel in the Region.

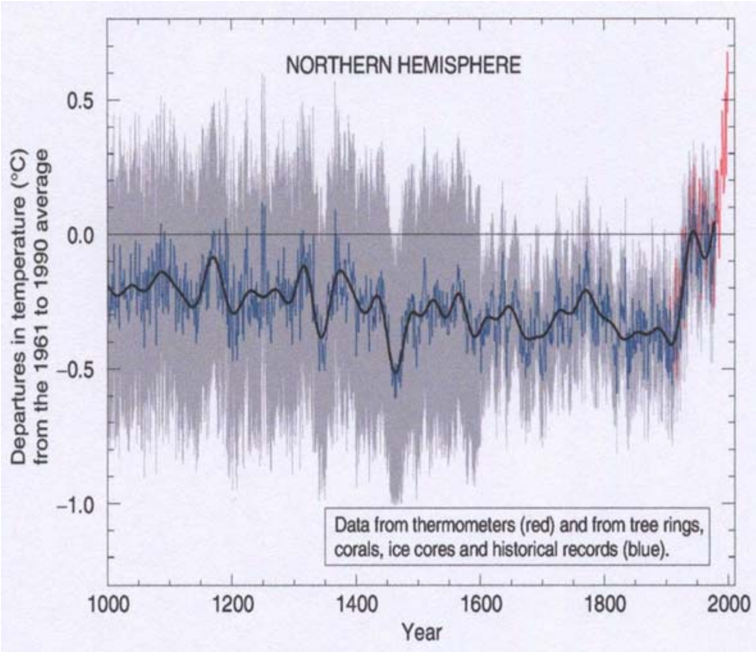
2. POLICY BACKGROUND

There are essentially two[7] converging drivers that provide the context for the development of wood energy for heating, CHP and electricity generation, with the synergy between them providing an important opportunity for the Region. These are:

1. renewable energy policy; and
2. rural development policy, especially relating to diversification of land-based enterprises (forestry and agriculture).

2.1. Renewable energy - strategic context

Global Climate Change is no longer a fringe issue of concern only to environmentalists; it is now recognised as a real and immediate threat and a matter of urgent political concern globally[8]. However, notwithstanding the undoubted threat that Climate Change poses, it also offers a powerful stimulus for positive change in the move towards sustainable, 'low carbon economies'. This in turn provides tremendous potential opportunities.



Temperature changes in the Northern Hemisphere over the past 1000 years, from IPCC

One of the key mechanisms for achievi
drive Climate Change is the large-scale deployment of renewable energy (RE) technologies.

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[7] A further parallel driver relates to waste policy and the liberation of woody arisings for potential energy uses, but this is not considered in this report which is focused on the woodland / forestry sector (see also Section 1).

[8] Global Climate Change (a.k.a. Global Warming, The Greenhouse Effect); the climatic impact of the increase in concentrations of atmospheric greenhouse gasses (mainly carbon dioxide) caused by humankind's activities. The most recent report from the Intergovernmental Panel on Climate Change (IPCC) states:

The globally averaged surface temperature is projected to increase by 1.4 to 5.8°C over the period 1990 to 2100.

The projected rate of warming is much larger than the observed changes during the 20th century and is very likely to be without precedent during at least the last 10,000 years …

To this end, a host of regulatory and fiscal measures are providing the catalyst for market development around the world so that, globally, the renewables sector is growing rapidly[9].

At a European level, the European Commission's White Paper *Energy for the Future: Renewable Sources of Energy* (White Paper COM(97) 599) lays down ambitious targets for RE deployment under what is termed *The Campaign for Take Off*. This sets an objective of a 12% contribution of renewable sources of energy to the Europeans Union's gross inland energy consumption by 2010. The Campaign indicates key sectors, and sets targets for each one, specifically including 1,000,000 dwellings heated by biomass. Importantly, it also calls for the support of a range of actors working in partnership to achieve implementation. These include national governments, regional authorities, local authorities, farmers associations and forest based industries, recognising that effective articulation between them is essential to achieving the targets it sets out.

The UK too is firmly committed both to 20% reductions in CO_2 emissions from 1990 levels by 2010[10] and to 10% renewables within the same time frame, with an interim target of 5% renewables by 2003[11]. To achieve these goals, a comprehensive framework of fiscal and regulatory instruments is now in place and has already begun to produce rapid deployment of RE electricity generating capacity in a number of technologies (see also Section 4 for further details).

> *"Whilst this is an ambitious target, it is not an end in itself. I do not want to see renewables stop at 10%. I want to see a strong, world-beating industry develop in the UK. I also expect renewables not only to generate power but also to provide heat and transport for our homes, industry and commerce in centuries to come."*
>
> Minister for Energy and Competitiveness in Europe

Renewable energy in the East of England

Within this context, the regions and the devolved administrations too are also beginning to move towards formalised renewables targets. In the East of England, this is being led by GO-East working alongside other stakeholders. Go-East is seeking to prepare new regional targets

[9] By way of an aside, it is notable, for example, that the Danish wind industry, which leads the world based on a strong domestic market, now employs more people than the UK coal industry.

[10] This is actually ahead of the requirement set out in the *Kyoto Agreement (1997)* which requires the UK government to reduce emissions of greenhouse gases to 12.5% below 1990 levels by 2008-12.

[11] See www.defra.gov.uk/environment/climatechange/; see also www.sustainable-development.gov.uk/search_by/subject/env_nat_res1.htm#0313c

for renewable energy, develop ownership of targets by stakeholders and LPAs and build such targets into Regional Frameworks and the RPG.

A report prepared for Go-East on behalf of the East of England Sustainable Development Round Table *Making Renewable Energy a Reality - Setting a Challenging Target for the Eastern Region* (www.sustainability-east.com/) paves the way for such targets, and specifically includes in Annex 5 *Scenarios and Targets for the Six Counties*. Based on this work, a 14% renewable energy target (by 2010) is proposed for the region embracing County targets of:

- Norfolk 17%
- Bedfordshire 13%
- Suffolk 12%
- Cambridgeshire 9%
- Essex 9%
- Hertfordshire 3%

Indicatively, this would mean Onshore Wind providing 1700 GWh/yr, Offshore Wind 1300 GWh/yr, Biomass 700 GWh/yr and Other 600 GWh/yr, although it is important to note that the focus of the report is on electricity generation only. If achieved (unlikely at the present rate of progress as it would require 150 offshore turbines, 400-500 onshore turbines and establishment of 138,000 ha of energy crops), this would reduce CO_2 emissions from the Region by 9%. It would also create 4400 jobs. Importantly in this context, a recent report by SQW Ltd for EEDA and others has recognised the major significance of employment in the wider environmental sector to the region, estimating that it supports between 108,000 and 180,000 jobs, and making explicit reference to biomass energy[12].

2.2. *Renewable energy from woodfuel*

The major sources of renewable energy harness energy from the sun - photovoltaics directly, wind or wave power indirectly. However, uniquely among renewables, the use of biomass is based on harnessing stored solar energy in the form of a fuel - whether woodfuel from forestry,

[12] *Environmental Prosperity, Business and the Environment in the East of England*, EEDA 2002; see http://www.eeda.org.uk/compdetails.asp?id=2145&sec_id=70.

agricultural by-products such as straw or dedicated ***energy crops*** grown specifically as an energy feedstock. This has a number of important implications that give it a far wider range of applications than most RE technologies:

1. Where wind and other renewables can generally only be used to generate electricity, biomass, being based on a fuel, can replace fossil fuels in all three sectors of the energy market:

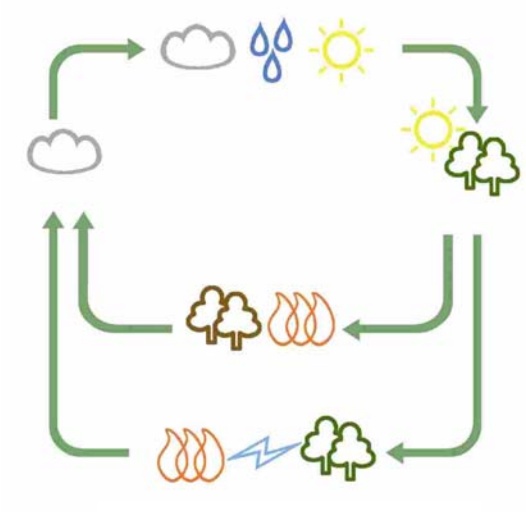
   - heating and process fuels
   - electricity generation
   - transportation fuels

   This opens up the whole of the energy market to penetration by biomass technologies, including woodfuel.

2. Because it is based on using a fuel in some form of prime mover (boiler or gasifier and so-on) biomass energy is essentially schedulable, ie. it can be used on demand, if necessary all year round, and is not dependant on external factors such as weather. This too allows it to be used in a wide range of applications, such as heating, where reliability and continuity of energy supply is important.

Wood as a low carbon fuel

Sustainably managed woodlands or energy crops are enduring sources of renewable fuel. When wood is burnt, it only puts back into the atmosphere the carbon dioxide (CO_2) it absorbed when it was growing. Coal, oil and gas release 'fossil CO_2' when they are burnt causing ***Global Climate Change***. Replacing fossil fuel with woodfuel typically reduces lifecycle CO_2 emissions by over 90%. For example, replacing gasoil in a central heating boiler with woodfuel produces a reduction in CO_2 emissions of approximately 350 grammes for every kilowatthour of heat produced (310 grammes compared to gas).



The bio-energy carbon cycle

While markets for liquid biomass transportation fuels are still a little way off, markets for biomass heating[13], Combined Heat & Power (CHP) and in some degree electricity generation are well established across Europe and are set to grow rapidly in the UK, where there is now a relatively comprehensive policy framework in place (see also Section 3.1).

[13] Including space heating, hot water services and process heat.

UK policy relating to bio-energy

In November 2002, the Energy Minister announced the creation of a *Renewables Advisory Board*, to assist with the development and implementation of renewables policy[14]. This is a major step, building on a raft of other policy initiatives:

- The DTI publication *New and renewable energy: prospects for the 21st century* represents conclusions drawn in response to a consultation undertaken during 2000[15]. It states that the government wishes to promote a climate of opportunity and to encourage innovation so that RE including biomass can become increasingly cost-effective and competitive with other more traditional sources of energy.

- Further to this, the Cabinet Office's Policy Innovation Unit (PIU) undertook a comprehensive *Energy Review* during 2001 (including a specific review of RE)[16]. The PIU report highlights not only the role that RE has to play in ameliorating climate change, but also its role in providing for energy security in the medium-long term. Biomass is identified as a key RE technology for the UK.

- MAFF as was published a *National Biomass Energy Strategy* in 1996 that has continued to inform current policy. This identifies forest residues, Short Rotation Coppice (SRC) and agricultural residues (principally straw and chicken litter) as the major prospective components of biomass supply chains in the UK. More recently, The Strategy for Sustainable Farming and Food[17], refers both to energy crops and to forestry in the context of diversification, noting that "Biomass products can contribute both to the UK's climate change and renewable energy targets". The parallel response to the Report of the Policy Commission on the Future of Farming and Food also refers to biofuels and local CHP and gasification plants.

- A report of the Royal Commission on Environmental Pollution *Energy – the changing climate* in 2000[18] highlights the need for urgent action to avoid problems from increasing greenhouse gas emissions as a result of increasing demands for energy. Biomass figures substantially in the various scenarios developed for deployment of RE technologies.

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[14] See www.dti.gov.uk/energy/renewables/policy_obligation/rab/index.

[15] See www.dti.gov.uk/renew/ropc.pdf.

[16] *The Energy Review*, Performance and Innovation Unit Feb 2002; see www.cabinet-office.gov.uk/innovation/2002/energy/report/index.

[17] DEFRA 2002, www.defra.gov.uk/farm/sustain.

[18] See www.rcep.org.uk/energy.

- The UK Climate Change Programme identifies an integrated package of measures to reduce greenhouse gas emissions[19]. As well as an action point to continue the current rate of afforestation, the programme also states that the most effective way for the agriculture and forestry sectors to contribute to reductions in greenhouse gas emissions is through the production of energy crops and woodfuel.

2.3. Rural regeneration and land-use diversification

Both of the main traditional land-use sectors, agriculture and forestry, are suffering from extremely difficult market conditions at the present time. The extent of the downturn in both sectors is such that the viability of many existing businesses is threatened and significant restructuring is already underway:

Farming / agriculture

Although productivity continues to improve (the Productivity Index for all UK farming in 2001 was 102.6 , with 100 being 1995), and subsidies remain high (just under £2.5 billion in 2001)[20], farm incomes have slumped from levels in the mid 1990's and remain extremely depressed:

Net farm income by type of farm	**1994/97**	**2000/01**	**2001/02**
dairy	100	30	59
cattle & sheep (LFA)	100	34	30
cattle & sheep (lowland)	100	-	-
cereals	100	13	10
general cropping	100	24	23
pigs & poultry	100	65	36
mixed	100	61	50
All types (ex horticulture)	**100**	**22**	**29**

Table 2.1: Net farm income in the UK (see www.defra.gov.uk/esg/m_overview).

Forestry

There is a similar picture in forestry. Overall, UK timber production continues to increase in line with the continuing maturation of post-war softwood planting, with total production in 2001 being 10,310,000 cubic meters overbark standing (m^3 OB[21]), of which 9,600,000 was softwood. However, the Coniferous Standing Sales Price Index, which effectively provides an overview of

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[19] See www.defra.gov.uk/environment/climatechange/.

[20] For statistics see www.defra.gov.uk/esg/m_overview.

[21] One m^3 OB standing equals approximately 0.8m^3 underbark, and weighs approximately 0.82 tonnes (softwood) or 09. tonnes (hardwood) when freshly felled.

market conditions, indicates quite clearly the degree to which the market is under severe pressure. After a very slightly better year in 2001, coniferous standing sale prices were 28.6% down for the year to September 2002 at £6.38 per m^3 OB in nominal terms (£5.48 in 1996 prices, the benchmark year). This puts them at approximately one third of their 1996 level in the Laspeyres Index[22]:

Year to	Average price £	Real average price £1996	Laspeyres Index (nominal; 100 = 1996)	Laspeyres Index (real; 100 = 1996)
30-Sep 1973	3.83	25.72	31.48	211.70
30-Sep 1996	15.97	15.97	100	100
30-Sep 2000	8.02	7.21	48.84	43.94
30-Sep 2001	8.32	7.34	49.94	44.08
30-Sep 2002	6.38	5.48	36.61	31.47

Table 2.2: UK Coniferous Standing Sales Price Index (see www.forestry.gov.uk/statistics).

This extremely depressed market probably represents an all-time low point for UK forestry and has serious consequences for the viability of the industry.

Against this background, there is now a well established policy framework to stimulate diversification of land-use and of the wider rural economy. In agriculture, this is directly reflected in the six measures of the England Rural Development Programme (ERDP)[23], and at the same time is tied into a parallel and wider emphasis on sustainable development and a long-term shift in subsidies towards agri-environment schemes.

In forestry, too, the Forestry Commission has developed a response to the same issues, embodied in the *England Forestry Strategy* (EFS)[24]. This sets out a four-fold role for woodlands and forestry in England, encompassing:

- forestry for rural development
- forestry for economic regeneration

[22] The Coniferous Standing Sales Price index is calculated on the basis of Forestry Commission sales and is published biannually. Price is defined as the average price received per cubic meter overbark standing. The Index is expressed in real terms (1996 prices) and is deflated using the GDP deflator published by the Office for National Stastistics (see Coniferous Standing Sales Price Index 18th November 2002 from www.forestry.gov.uk/statistics for further details).

[23] www.defra.gov.uk/erdp/erdphome; see also the England Rural Development Plan 2000-2006 for the East of England Region (MAFF 2000) which makes specific reference to renewables, and biomass in particular, in providing diversification opportunities in the Region.

[24] *England Forestry Strategy – A new focus for England's Woodlands*, Forestry Commission 1999; see www.forestry.gov.uk.

- forestry for recreation, access & tourism
- forestry for environment & conservation

Within this wider policy context, the development of woodfuel (including energy crops) is recognised as providing a number of cross-cutting benefits, addressing the need to diversify rural incomes whilst brining significant potential environmental benefits. The EFS, in particular, draws specific reference to assisting diversification through encouraging the use of woodfuel for energy production using the most efficient technology, something strongly echoed in the development of a Regional Woodland Strategy[25].

[25] The draft Woodland Wealth Appraisal that will ultimately inform the development of a Regional Woodland Strategy was related to stakeholders at Duxford in December 2002. It gives specific attention to wood as fuel and specifically recommends development of the wood energy market as a key need in the region.

The Community Forests

The Community Forests are a national programme initiated in 1989 by the Countryside Commission and the Forestry Commission.[26] Their goal is to secure significant environmental improvements and the widest possible community benefits within their catchments (which reach c.50% of England's population). While each has it's own specific goals and targets, they all have a central focus on securing substantial new woodland planting - up to 30% of each area will be planted, although providing a wooded framework rather than blanket coverage with trees.

Three of the twelve Community Forests are in the East of England:

- Thames Chase in Essex
- Watling Chase in Hertfordshire
- Marston Vale in Bedfordshire

CF	Original woodland cover - %	Original woodland cover - ha	Planned new planting (30-50 yrs) - ha	Area planted 1991-1999 - ha
Marston Vale	3.6%	600	4120	173.7
Thames Chase	9.7%	955	2000	172.4
Watling Chase	7.9%	1284	2300	201.5

Table 2.3: Woodland planting in the Community Forests.

The educational and public communication role of the Community Forests makes them in many ways ideally suited to improving awareness of woodfuel. One of the most obvious mechanisms for this is via the development of accessible ***exemplar projects*** on their patches, together with appropriate dissemination programmes. In this regard, Marston Vale already have a wood boiler at the Forest Centre where they are based and Thames Chase are planning for one in their new visitor centre development. Unfortunately, the former is a poorly specified installation and requires remedial work before it can be used as an exemplar, something that should certainly be addressed.

See Section 4.3 and the Action Plan at Section 5 for a further elaboration.

[26] See www.countryside.gov.uk/communityforests.

2.4. Other

As well as the specific sectoral issues pertaining to forestry and agriculture, and the policy framework relating to them, there is a broader rural policy framework that recognises the wider issues of social and economic deprivation and some of the pressures on rural areas, for example for new housing. This is explicitly recognised in EEDA's Corporate Plan 2003-2006, which acknowledges 'pockets of sever urban and rural deprivation' in the region and makes a specific commitment to the concept of a *Rural Renaissance* based on *sustainable and vibrant rural communities*. Furthermore, the Plan also makes a strong commitment to sustainable development, with three strategic priorities:

- encourage the take-up of sustainable policies and practices by all businesses;
- promote the environmental business sector;
- protect and support the natural and built environment.

Under these priorities, a number of forms of intervention are proposed, specifically including *supporting strategic action to develop biomass energy production*[27].

Similarly, the Countryside Agency's strategy document *Towards Tomorrows Countryside*[28] talks of working in partnership with small countryside businesses to achieve sustainable development. Renewables, particularly community led, are specifically identified within this vision, and in 2002 the Agency launched the Community Renewables Initiative specifically to foster such schemes[29].

Finally, for details of the most local policy level, reference should be made to the County *Rural Development Programme Strategies* (RDP's) that mesh with EEDA's wider Regional Economic Strategy. Those for both Norfolk and Suffolk include specific measures relating to support for agricultural diversification, as well as more generalised support for business and for rural communities.

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[27] For further information, see also www.eeda.org.uk/doclib/consultation%20draft%204th%20oct.doc.

[28] The Countryside Agency Strategy 2001; see www.countryside.gov.uk/publications.

[29] See www.cri.energyprojects.net.

3. THE WOODLAND SECTOR IN THE EAST OF ENGLAND

3.1. Woodland cover

The East of England has a huge woodland resource that is currently substantially under utilised. Total woodland coverage is 139,112 ha[30], covering 7.3% of the land area (Table 3.1), an increase from 5.8% in 1980[31]. This includes 113,094 ha of woodland in 7,767 blocks of 2 ha or more (the general measure of a substantive woodland[32]), each with an average size of 14.6 ha (note: unless stated otherwise, all further references to woodlands refer to the >2 ha category).

For Norfolk and Suffolk[33], the equivalent figures are:

- Norfolk: 52,740 ha total woodland coverage = 9.8% of the land area, an increase from 8.0% in 1980, including 2,191 woodlands over 2ha, amounting to 44,157 ha, average 20.2 ha.
- Suffolk: 31,435 ha total woodland coverage = 8.3% of the land area, an increase from 7.4% in 1980, including 1,859 woodlands over 2ha, amounting to 27,332 ha, average 14.8 ha.

The predominant forest type is broadleaved woodland, accounting for over half of all woodland (55.6%, see Table 3.2), with conifers accounting for just under a quarter (24.8%, Table 3.2). This ratio has changed in some degree since the last woodland census in 1980, with the area of broadleaves having increased at a much greater rate than that of conifers. The presence of substantial FE forestry blocks in Norfolk and Suffolk (particularly Thetford and Rendlesham Forests) slightly skews the figures for these counties, which are both just under half broadleaved (c.45%) and approximately one third conifer (30% Norfolk, 36% Suffolk; see also Table 3.2), although they too reflect the same trend towards increasing broadleaved woodland since 1980.

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[30] For the statistics used and additional information, see the *National Inventory of Woodland & Trees, East of England Region*, Forestry Commission 2002 as well as the equivalent county versions for Norfolk and Suffolk (all counties are available).

[31] Itself an increase from just 3.7% in 1900, reflecting a long term but gradual trend towards increasing woodland cover.

[32] The c.25,000 ha in smaller blocks is made up of over 45,000 woodlands with a mean area of just 0.6ha. While these are important as landscape features, for biodiversity, sporting and so-on, they are not productive woodlands in terms of timber (or woodfuel) and are not included in the Main Woodland Survey by the Forestry Commission (they are covered by the Survey of Small Woodland and Trees).

[33] The FC Inventory is published at county level but it is not readily possible to provide statistics specifically for the RPA's. Thus, only the county level information is provided herein. There is no particular reason to suspect that the RPA's differ substantively from the countywide patterns indicated, and in theory it would be possible to extrapolate figures for them from the respective proportions of the counties that they represent. However, this has not been undertaken in order to avoid creating any

Woodland size (ha)	Woodland Area	(ha)		Woodland Area	%
2.00 and over	East of England Norfolk Suffolk	113,094 44,157 27,332		East of England Norfolk Suffolk	81.3 83.7 86.9
0.25 -<2.00	East of England Norfolk Suffolk	24,030 7,889 3,751		East of England Norfolk Suffolk	17.3 15.0 11.9
0.10 - <0.25	East of England Norfolk Suffolk	1,989 693 353		East of England Norfolk Suffolk	1.4 1.3 1.1
Total area of woodland	East of England Norfolk Suffolk	139,112 52,740 31,435		East of England Norfolk Suffolk	100.0 100.0 100.0
% Woodland land cover	East of England Norfolk Suffolk	7.3 9.8 8.3			

Table 3.1: Woodland area by woodland size class.

Forest type	Woodland 2.0 ha and over (ha (%))		
	East of England	Norfolk	Suffolk
Conifer	28,013 (24.8)	13,225 (30.0)	9,883 (36.2)
Broadleaved	62,924 (55.6)	20,045 (45.4)	12,282 (44.9)
Mixed	13,397 (11.8)	6,486 (14.7)	3,155 (11.5)
Coppiced	107 (<0.1)	0 (0)	6 (<0.1)
Copp-w-Standards	805 (0.7)	332 (0.75)	43 (<0.2)
Windblow	0 (0)	0 (0)	0 (0)
Felled	1,043 (0.9)	754 (1.7)	192 (0.7)
Open Space	6,806 (6.0)	3,314 (7.5)	1,772 (6.5)
	113,094 (100)	44,157 (100)	27,332 (100)

Table 3.2: Woodland types.

Although the main public sector estate managed by Forest Enterprise (FE) is substantial, FE nevertheless manages only just under a quarter (23%) of the woodland total (25,702 ha), with

impression of providing definitive figures. The same applies to all of the other County-based figures given below.

77% of the woodland area privately managed[34] (87,392ha). Once again, the presence of large-scale FE forestry blocks somewhat skews the figures for Norfolk and Suffolk, which are 31% FE in Norfolk (13,804 ha) and 35% in Suffolk (9,656 ha).

It is also broadly true to say that the private estate is characterised by smaller, predominantly broadleaved woodlands (average size 11.3 ha, 68% broadleaved across the region (13.1 ha / 60% Norfolk; 9.2 ha / 67% Suffolk)), the FE estate by larger, predominantly conifer woodlands (average size 231 ha, 70.6% conifer across the region (263 ha / 70% Norfolk; 509 ha / 81% Suffolk))[35].

3.2. The current situation

At the present time, the existing areas of woodland and forest make a very important contribution to the 'wealth' region in terms of:

- Biodiversity: these woodlands represent a significant ecological resource with 27,499ha of woodland in the region as a whole classed as Ancient Woodland (24% of all woodland) and a further 8,095ha classed as Ancient Semi-Natural Woodland (ASNW) (16% of total). These woodlands are often rich in rare plant species and support a notable range of breeding birds, dormice and 10 species of bat. Ancient, species-rich hedgerows are common in many parts of the region and internationally important birds such as woodlark and nightjar breed successfully in the conifer clearfell areas of Thetford Forest.
- Landscape diversity: the significant numbers of relatively small woodlands, many Ancient / Ancient Semi-Natural Woodlands, provides an important element of landscape diversity in an otherwise predominantly arable region. This applies even in areas of relatively low tree cover, such as the Fens of Norfolk and Cambridgeshire, where their impact is arguably just as important as elsewhere in what could otherwise be a particularly stark landscape.
- Social amenity value: although public access is not uniform, there is extensive public access to the region's woodlands, particularly the FE estate, and this access is widely used for leisure and recreation by large numbers of people (approximately one million people visit Thetford Forest alone each year). More niche activities such as paintballing or off-road driving are also undertaken.

[34] Included within 'privately' managed woodlands are reasonably large areas managed by charities (eg. the Wildlife Trusts and the Woodland Trust) and by Local authorities or other public bodies.

[35] Though the pattern broadly holds true, it is worth noting that in parts of North and North-West Norfolk in particular there are some larger blacks of ostensibly more commercial forestry in the private sector, mainly on the large estates that characterise the area (a number of which fall within the Norfolk RPA).

- Sporting value: a great many of even the smallest woodlands and woodland features are used for sporting purposes, primarily to provide cover for both wild and reared game birds. For a great many woodland owners, this is one of the few motivations for undertaking any management operations, and it is important not just in this respect but also because of the potentially high value it represents in commercially run shoots.
- Timber value: although under intense economic pressure, the Region's woodlands nevertheless produce a substantial volume of wood products, primarily timber but also other niche products such as charcoal or hurdles, and provide an important element of both rural income and employment.

The draft *Woodland Wealth Appraisal*[36] provides a quantitative assessment of all of these benefits. It estimates that the net annual output value of timber production in the Region is £17.8m, but that the gross output value of forestry and timber processing, including indirect and induced effects, is c.£236m. It also estimates that the Region's forestry industry directly supports 1249 Full Time Equivalent jobs (on the production side only).

Overall, these are significant and diverse benefits. However, a long-term pattern of increasing neglect, substantially reinforced in recent years by the depressed state of the forestry industry, threatens to significantly erode this value.

Although Forest Enterprise runs a large-scale commercial operation in Thetford Forest, in the current climate in British forestry the viability of timber production even for this operation is reduced and private woodland in the Region suffers from significantly greater problems. Thus, of the total woodland estate, it is estimated that as much as half, or >40,000 ha in Norfolk and Suffolk, is largely unmanaged. *All* of this woodland is in the private sector, ie. perhaps 80% or more of the private woodlands are undermanaged.

Over time, the result of such neglect is that increasing numbers of these woodlands have become in some degree 'derelict' - in poor overall health, having little amenity value and much reduced sporting value, and, crucially, of little or no commercial value to the farm or estate. In this context, a survey of woodland owners conducted by Anglia WoodNet in 2001 identified lack of economic return as the single most commonly cited reason why woodlands are unmanaged[37].

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36 Draft Executive Summary presented at a Launch Conference, Duxford December 2002.

37 *Woodland Assessment Project – report of survey*, Anglia WoodNet 2001.

Although the highly depressed state of the timber market as a whole makes the problem particularly acute at the present time, this picture of neglect is a long-term one driven by a number of complex and inter-related factors. As indicated, one result of this history of neglect is a significant decline in the quality of standing material, which then produces a self-reinforcing trend:- reduced quality ► reduced value ► further neglect ► further reduction in quality and so-on.

While this applies particularly to the relatively small blocks of mainly mixed or broadleaf woodland that are a ubiquitous feature of farms and estates in the region, it also applies to many ostensibly more 'commercial' plantations, some of which may remain unthinned 40 or more years into rotation (what might be termed 'undermanaged forestry' rather than 'undermanaged woodland'). This means that any attempt to re-introduce positive management has to deal with a standing crop of predominantly low-grade material. However, the region is remote from the major pulp markets in the UK, which are anyway in decline, so that haulage costs have a detrimental effect on prices obtained at roadside. This situation very often results in the cost of harvesting roundwood exceeding the price obtained from pulp buyers. In better crops and in better market conditions the net cost of harvesting low grade roundwood is subsidised by the return from higher value products. Even in good times this erodes the return from sale of sawlogs and bars and the price that can be paid for standing timber, but at the present time market conditions are such that more and more woodland is slipping into economic unviability, generally with an attendant loss of wildlife, sporting and amenity value.

With returns from higher grade products significantly diminished but nevertheless generally profitable, the degree to which the limited market opportunity for low grade material represents a major constraint on improving woodland management can hardly be over-stated. It is in this context that woodland owners, managers and contractors in the region are all eager to see new, local markets of the type represented by the energy market, and the re-introduction of positive management to the large 'neglected' or 'undermanaged' resource this could bring would produce a range of attendant benefits (see Section 1.1).

3.3. The woodfuel resource

Although inevitably somewhat broad-brush, typical yield figures may be applied to the areas of woodland given earlier to provide an indication of the sustainable yield of timber that they will produce. The following assumptions have been made for the region:

- yield class 12 for conifers[38]
- yield class 4 for broadleaves
- yield class 7 for mixed woodlands

Applying these to the respective areas results in the average timber increment figures for each of the three main woodland types summarised in Table 3.3 below. Production from coppice and felled areas is disregarded for the purposes of these calculations but is likely to have a slight additional effect on capacity.

Note: Forestry Commission conversion factors of 0.818 green tonnes/m^3 for conifers, 0.900 for hardwoods, and 0.859 for mixed timber, have been applied to produce the tonnage figure for annual increment given in each of the third columns.

Forest type	Yield class	East of England			Norfolk			Suffolk		
		ha	m3	t	ha	m3	t	ha	m3	t
Conifer	12	28,013	336.2	275.0	13,225	158.7	129.8	9,883	118.6	97.0
B'leaved	4	62,924	251.7	226.5	20,045	80.2	72.2	12,282	49.1	44.2
Mixed	7	13,397	93.8	80.6	6,486	45.4	39.0	3,155	22.1	19.0
Total		104,334	681.7	582.1	39,756	284.3	241.0	25320	198.8	160.2

Table 3.3 Mean annual timber increment by woodland type (volume and tonnage figures as 000's).

The annual increment for the region as a whole of 582,000 tonnes is the average amount by which the standing timber increases in volume each year assuming an even distribution of age classes of stands of timber. As indicated above, the fraction that could be made available for use as woodfuel comes from the small roundwood portion of the crop, since prices for woodfuel cannot compete with those paid for larger dimensioned sawmill grade timbers.

Although acknowledged to be a simplifying assumption, it is assumed that the age class distribution for conifer and broadleaves respectively is similar to the national average since the same afforestation policies and incentives have applied to the whole of the UK. This being the case, the proportion of sawlogs to small roundwood in the regional annual harvest will be similar to the national figures in which small roundwood for the pulp and woodpanel industries made up 34% of UK conifer deliveries in 2000 and 37% of the broadleaved output[39]. These

[38] The term *yield class* refers to solid cubic meters of increment per annum per hectare, ie. yield class 12 = 12m^3/ha/an.

[39] Derived from figures published in *British Timber Statistics 2000*, Forestry Commission, September 2001.

percentages, applied to the figures given in Table 3.3, suggest the following sustainable yield of small roundwood:

Forest type	% small roundwood	East of England		Norfolk		Suffolk	
		total	r'wood	total	r'wood	total	r'wood
Conifer	34	275.0	93.5	129.8	44.1	97.0	33.0
B'leaved	37	226.5	83.8	72.2	26.7	44.2	16.4
Mixed	35	80.6	28.2	39.0	13.7	19.0	6.7
Total		582.1	205.5	241.0	84.5	160.2	56.1

Table 3.4 Estimated mean annual increment of small roundwood (000s tonnes)

3.4. Commentary

Although very much an indicative figure, the estimated sustainable productive capacity of small roundwood for the region is approximately 205,000 tonnes per annum (tpa)[40] (84,500 tpa for Norfolk and 56,100 tpa for Suffolk). Under present market conditions, there can be little doubt that there is an under utilisation of productive capacity which has had a cumulative effect on woodland management in the region. In the private sector in particular, a backlog of thinning in even commercial plantations, combined with a long-term pattern of neglect throughout much of the smaller woodland estate, means that the short-term yield of low-grade material could be even greater (see also 3.2, above).

However, even based on the longer-term sustainable yield, the volume of material available is substantial. Although the development of large-scale (multi-megawatt) electricity generation plants would rapidly put pressure on this resource, for reasons set out below (Section 4.2) this now seems unlikely, at least in the medium-term. In contrast, in the context of smaller-scale developments of wood heating, or possibly CHP, the resource *per se* is not limiting. In Norfolk alone, the existing resource could readily provide for several hundred boilers of the type to be found at the EcoTech Centre in Swaffham, providing a local use for a sustainable local resource.

[40] Note: these figures are for small roundwood and do not take account of the residue fraction (branches and tops) that can be recovered by woodfuel operations in appropriate circumstances. This can amount to 10-20% of the total standing timber (of which the roundwood itself forms only a portion). Although in practice it will not be possible to recover all the residues, this nevertheless represents a significant additional volume of material to be considered in the context of a woodfuel use.

4. THE MARKET OPPORTUNITY

4.1. Fiscal and regulatory environment

The raft of strategy papers and consultations that have been produced over five or more years (see Section 2) have now resulted in a positive policy framework and concrete fiscal and regulatory mechanisms to promote low carbon technologies, RE technologies and biomass in particular. This relatively complicated web of measures effectively provides the driver for market development in the UK and includes:

- **The Climate Change Levy (CCL).** The CCL came into force in April 2001 and represents a tax on all non-domestic energy use (other than fuel oil, which is covered by pre-existing duty arrangements). Currently CCL rates are set at 0.15 pence / kilowatt hour (p/kWh) for fuels (coal, gas) and 0.43 p/kWh for electricity. Woodfuel, being renewable, is exempt from the Levy. In addition, a number of industry sectors have negotiated *Climate Change Agreements (CCA's)* under which they gain an 80% reduction in CCL payments in return for agreeing to binding energy or carbon savings targets[41]. Switching even partly to use of renewable energy can play an important role in helping companies to meet these targets, with tremendous potential value if it thereby secures their CCAs.

- **The Renewables Obligation (RO).** The RO came into force in April 2002, effectively replacing the earlier Non Fossil Fuel Obligation (NFFO) as the principal mechanism for supporting renewable electricity generation in the UK[42]. Essentially it obliges energy supply companies to procure an increasing proportion of renewable energy, starting at 3% for 2002-3 and ramping up progressively to 10.4% from April 2010. Electricity generated from biomass falls within the scope of RE technologies eligible to claim *Renewable Energy Certificates (ROC's)* under the RO.

- **Enhanced Capital Allowances (ECA's).** ECA's represent a tax incentive for investment in efficient 'low carbon technologies' by providing 100% capital allowances in the first depreciation year for approved capital investments made after April 2001[43]. Criteria for registering biomass boiler plant under the scheme are already available for plant rated at less than 300kW thermal output, and those for larger plant are in preparation, with a draft proposal submitted in December 2002 for inclusion in the 2003 round of applications.

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[41] See www.hmce.gov.uk/business/othertaxes/ccl/red-rate-certs for list of sectors and companies.

[42] See www.dti.gov.uk/energy/renewables/policy_obligation/obligation_2002.pdf.

[43] See www.eca.gov.uk/.

- **The UK Emissions Trading Scheme (ETS).** The ETS, which has been developed by the DTI with the support of the CBI, represents the government's response to it's previous commitment to provide a UK carbon trading mechanism[44]. It effectively became live in March 2002 with the results of the first 'auction' under which 34 organisations will receive an average of £52.37 per tonne of baseline CO_2 reductions made from a audited baseline over a five year period. Participating organisations include Shell, BP, British Sugar, Asda, Tesco, Barclays Bank, Ford and Rolls Royce amongst others (for a full list see website). 'Project' schemes designed to produce CO_2 offset specifically to provide for offset trades with third parties are likely to be launched early in 2003.

- **The Bio-energy Capital Grant Scheme (BeCGS).** The BeCGS is a UK-wide programme funded by the Department of Trade and Industry (DTI) and Lottery Distributor the New Opportunities Fund (NOF)[45]. The scheme provides grant funding towards the cost of equipment for biomass fuelled heat, CHP and electricity generating plants under a number of priorities:
    - 1a: large-scale, state of the art electricity generating installations >20MW
    - 1b: electricity generating or CHP installations, with a preference for CHP
    - 2: large-scale installations using technologies with much higher electrical generating efficiencies than current state of the art, and with significant future development potential (for example Combined Cycle Gasification)
    - 3a: projects comprising clusters of heat or small CHP installations
    - 3b: larger industrial heating units (>500kW) for process or space heating

  Although there is a preference for energy crops throughout the scheme, forestry material and agricultural by-products are also identified as eligible fuels (as well as recovered wood waste for 1a and 2). Note: total funding for the scheme is £66 million to be committed by March 2006 and spent by March 2010. It is likely that a significant proportion or all of the existing moneys will be committed via bidding rounds that closed in July 2002 (3a and 3b) and October 2002 (1a, 1b & 2). Although this may limit the amount of funding that comes to the East of England from this source, two of the successful bids (under 3a and 3b) were made by Econergy Limited, based in the Region. It is also likely that further moneys will

[44] See www.emissions-trading.info/.

[45] See www.dti.gov.uk/renew/eoi; for results of 3a & 3b, see http://www.gnn.gov.uk/gnn/national.nsf/TI/D628A5395E604CDE80256CB70054CBDA?opendocument.

become available should the initial tranche of funding be successfully deployed and have a substantive impact.

- **The Bio-energy Infrastructure Scheme (BeIS).** The BeIS is currently being developed on an inter-departmental basis covering England, Scotland, Wales and Northern Ireland to provide support for biomass supply chain development[46]. £3.5 million is available from DEFRA for the UK as a whole, with the scheme likely to be launched in the first half of 2003. Examples of aspects of infrastructure development that might be supported include capital for purchase of specialist equipment, eg. forestry chippers, by businesses wishing to diversify into the woodfuel market, capital support for other infrastructure such as woodfuel storage sheds, and support for 'producer groups', eg. groups of woodland owners wishing to set up to produce woodfuel.

- **The Community and Household Capital Grants Scheme (CHCGS).** The CHCGS is targeted towards individual households or buildings / land owned by non profit making organisations with a strong community interest, including local authorities. The scheme was launched in January 2003 under the label *Clear-Skies*[47], with £13.7 million to provide capital support for defined project types (including biomass heating).

- **The Energy Crops Scheme (ECS).** The ECS is operated by DEFRA in partnership with the Forestry Commission funded by £29 million from the Rural Development Programme (RDP)[48]. The scheme has two components to support crops specifically intended for energy production:

  - establishment grants of £1,600 / ha (grassland) or £1,000 / ha (Set-aside) for SRC, and of £920 / ha for miscanthus;

  - grants of up to 50% of the costs of setting up producer groups for SRC production in England.

  Anglia EnCrops is an SRC producer group in the East of England which has been set up under the scheme and currently has c.80ha of SRC established within its membership.

- **R&D programmes.** Both DEFRA and, more particularly, the DTI operate R&D programmes to support technical developments in biomass (and other RE technologies in the case of the DTI). The DTI's *New & Renewable Energy Programme* has been ramping up and now

[46] See www.defra.gov.uk/farm/acu/energy/infrastructure.

[47] See www.Clear-Skies.org.

[48] See www.defra.gov.uk/farm/acu/energy/ecs.

stands at £25 million per annum. This is used to co-fund a wide range of projects under twice-yearly calls for proposals, each of which sets out the current range of priorities[49].

- **Other.** As well as the above, which provide the core drivers, substantial funding that has potential relevance to biomass energy schemes is available via a wide range of other schemes including (non exhaustive):
    - the Energy Saving Trust (EST) Community Energy Scheme - see www.est.co.uk/communityenergy;
    - the Community Renewables Initiative (CTI) Local Support Teams - see www.cri.energyprojects.net;
    - the England Rural Development Programme (ERDP) - see www.defra.gov.uk/erdp/erdphome;
    - the Carbon Trust & Carbon Foundation - see www.thecarbontrust.co.uk/thecarbontrust/default;
    - regional funding via the Regional Development Agencies (RDA's) and also from sources such as EU Objective 1 and 2 Structural Funds - see www.eeda.org.uk;
    - EU R,D&D funding, primarily via the so-called 6th Framework, for example via programmes such as ALTENER;
    - Landfill Tax Credits for local community type projects;
    - the Woodland Grant Scheme (WGS) (and Farm Woodland Premium Scheme under the ERDP).

Summary

Although the number of measures, themes and priorities can become confusing, overall the fiscal and regulatory environment for the development of biomass, including woodfuel, is extremely positive. Challenges remain, and there is no doubt that the role of the regions in helping to translate the raft of national policies and measures into local action is potentially pivotal. Against this background, the remainder of this section considers the main market opportunities in the East of England and outlines a number of suggested actions that are elaborated into an Action Plan in Section 5.

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49 See www.dti.gov.uk/renewable/.

4.2. Biomass electricity generation

NFFO plants

Unlike most of the rest of the UK, the East of England already has the beginnings of a wood energy industry driven by the fuel demand generated by the FibroThetford power station, which generates electricity under a 15 year Non-Fossil Fuel Obligation (NFFO) contract.

The NFFO was the original UK support mechanism for renewable power generation set up under the 1989 Electricity Act. The Minister of State used the powers granted to him by the Act to lay successive 'orders' that obliged the then twelve Regional Electricity Companies (RECs) to purchase electricity from renewable generation plants up to a given capacity in MegaWatts (MW). Contracts were awarded via a competitive tendering process in five *tranches* that accorded with the successive NFFO orders during the 1990's. Successful bidders secured a supported price for electricity produced, guaranteed and index linked for 15 years for the 3rd and 4th rounds (those in which biomass figured as a specific technology band).

Case study: the FibroThetford power plant

The 38MW FibroThetford plant at Croxton, Thetford was commissioned in 1998 and generates electricity under a NFFO-3 contract. It mainly uses poultry litter as fuel, but it also uses a proportion of woodfuel estimated to be in the region of 50,000 tonnes per annum. This material is drawn from a 20 mile radius, primarily 'residues' from the FE estate in Thetford Forest.

Above: the FibroThetford power station as seen from the A11

Under the NFFO a number of contracts were awarded to biomass fuelled power stations in the East of England:

- The 12MW$_e$ Fibropower plant at Eye Airfield, Suffolk was the first biomass power station in the UK and the first of its kind in the world, generating electricity using poultry litter as a fuel. Awarded a contract under the 'Waste and other' technology band in NFFO-2 in 1991, the plant did use a small proportion of woodfuel unit it's NFFO contract expired in 1998[50]. Since then, the plant has ceased to use woodfuel.

- The 38MW$_e$ FibroThetford plant at Croxton, Thetford was commissioned in 1998 and generates electricity under a NFFO-3 contract in the 'Biomass - other' technology band. Like it's predecessor, it too mainly uses poultry litter as fuel, but it also uses a proportion of woodfuel. This is estimated to be in the region of 10-15% of its total fuel requirement of 450-480,000 tonnes per annum. In round terms, this equates to something in the region of 50,000 tonnes of woodfuel per annum.
- The 32MW$_e$ Elean plant at Sutton, Ely was commissioned in July 2001 and also generates electricity under a NFFO-3 contract in the 'Biomass - other' technology band. This plant solely uses straw as feedstock, although it was originally designed as a 'multi-biomass fuel plant' and the boiler itself has the facility to burn woodfuel alongside straw (in the region of 40-50,000 tonnes per annum, or 25% of total fuel burn). However, to date the woodfuel storage and handling facilities that would be needed for the plant to burn woodfuel in practice have not been installed and it is believed that the investment required to do so is not regarded as being warranted by the plant's shareholders. Instead, the operators are focusing on developing miscanthus as a source of feedstock that can be used in baled form alongside straw in the existing handling facilities.
- The 5.5MW$_e$ Novera project at Eye Airfield, Suffolk was awarded a NFFO-3 contract under the 'Biomass Gasification' technology band. This plant would solely use woodfuel as a feedstock, with a requirement of approximately 65,000 tonnes per annum. However, although planning permission was secured in 1999, the project has thus far been unable to achieve financial close and to proceed to construction. This is particularly because of the difficulties encountered by successive developers in securing a robust turnkey construction contract for the gasification plant, which must be regarded as essentially pre-commercial technology at the present time.

In addition to the above, two other biomass power plants have also made efforts to procure woodfuel in the East of England:

- The 8MW$_e$ Project ARBRE at Selby in Yorkshire is a pioneering Combined Cycle Biomass Gasification plant being constructed under a NFFO-3 contract. The plant will use a combination of forestry derived material alongside locally sourced SRC and has had plans

[50] The original NFFO contracts under NFFO-1 and NFFO-2 all terminated in 1998, unlike the later 15 year contracts.

to source a proportion of the former from the East of England. However, the plant has been bedevilled by a combination of technical and commercial problems - at the time of writing it has not yet been successfully commissioned and has been placed into voluntary liquidation. Nevertheless, considerable efforts are being made to rescue the project and it may yet be successfully commissioned, although it is now rather less likely that it will draw substantial volumes of woodfuel from the East of England.

- A 32MW_e project at Corby has been under development for some time by EPR Ltd, the developer of the Ely straw plant, based partly on two NFFO-3 contracts. This plant would represent a very similar model to Ely, but with the woodfuel facility in place from the outset and with an anticipated annual woodfuel requirement in the region of 50,000 tonnes. However, while apparently near to financial close late in 2001, progress in developing this plant has been stalled for some time (although there are some indications that development activity may be reviving).

Summary and future developments

The East of England has seen a significant level of interest in the development of biomass electricity generating plants over a period of perhaps 10 years, stretching back to the early 1990's when the NFFO bidding process got underway. However, at the time of writing, only the FibroThetford plant is commissioned and using significant quantities of woodfuel. More particularly, the prospects for construction of the dedicated wood-fuelled plant at Eye by Novera now seem remote.

Bidding for NFFO contracts was withdrawn in January 2000, to be replaced by a ***Renewables Obligation*** created under a framework provided by the Utilities Bill. This came into force by statutory instrument on the 1st April 2002 and, in a UK context, will provide further market stimulus to biomass electricity generation. However, the economics of biomass electricity generation are such that projects of this kind generally require additional support over and above the increased value for the electricity generated provided for by ROC's (***Renewables Obligation Certificates***). This has been addressed by the launch of the Bio-energy Capital Grants Scheme (see 3.1 above), but so far as the author is aware no substantive bids were made into the scheme from the East of England when the application window closed at the end of October 2002. It is possible that further moneys may become available under this scheme if the initial applications lead to successful projects being developed. However, this will certainly not happen in the short term, if only because the lead times for the initial projects to prove the scheme will be so long (no projects are likely to be commissioned before 2005).

In summary, therefore, unless the Novera project at Eye is somehow resurrected, it appears unlikely that there will be new substantial biomass generating capacity built in the East of England in the short-medium term (before 2006/7 at the very earliest)[51].

The market opportunity

Essentially, the market opportunity provided by biomass electricity generating plants is for the supply of feedstock - in this context supply of woodfuel. In this regard, the significance of the existing FibroThetford plant is not to be underestimated since this plant alone already draws a substantial volume of woodfuel. Against this background, there is a clear market opportunity to bring currently undermanaged woodland and 'undermanaged forestry' back into more productive use to provide feedstock to this plant since the low-grade material produced from this type of woodland can be well suited to the energy market. Indeed, this has already begun to happen in a relatively modest way.

However, the woodfuel catchment for the FibroThetford plant is essentially limited to 20 miles and most of the material supplied to it is provided from the large-scale operations of Forest Enterprise (FE) in Thetford Forest. Thus, its impact on the broader woodland / forestry sector has hitherto been relatively limited. This has also been in some degree exacerbated because the plant itself has suffered from substantially greater levels of 'enforced outage' (downtime due to unscheduled breakdowns) than would generally be expected. This has limited the quantities of woodfuel it is able to buy, which particularly limits the quantities drawn from the private sector since much of the FE derived material is provided via a forward contract with a single wood-chip supplier.

In addition, the feedstock cost structure for the plant is substantially driven by the cost of poultry litter (little more than the cost of haulage). This means that the price paid for woodfuel, though higher than that for litter, is relatively low. This in turn makes it harder for material from the private sector, where production costs are higher due to a variety of factors including scale, access, nature of the material and so-on, to compete with the FE residues.

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[51] It should be noted that the Renewables Obligation provides not only for dedicated biomass electricity generating plant but also for co-firing of biomass feedstocks into existing coal-fired plant. Elsewhere in the UK this is potentially very significant in providing a relatively short-term mechanism for stimulating the development of a woodfuel market and of woodfuel supply chains (although a combination of technical and commercial factors mean that forestry material is very definitely secondary to waste wood and even to pellets in this market). However, there are no large-scale coal-fired power stations within the East of England and just a small number of smaller CHP plant (the author is directly aware of just one operated by British Sugar at Cantley in Norfolk). Thus, while co-firing *may* have some impact in terms of exports to large facilities or possibly use in small plant in the region, this is unlikely to be substantial.

For the reasons set out above, further large-scale market development, of the kind stimulated by electricity generating plant (ie. generally 50,000 tpa or more), is now unlikely in the short-medium term. There *may* be some opportunities for export of woodfuel to neighbouring regions as the wider UK woodfuel market matures in the medium term, but the market simply will not grow to the level that at one time seemed quite possible - perhaps in excess of 300,000 tonnes per annum[52]. Nevertheless, the region does have the beginnings of a volume market for woodfuel and, even if growth is likely to be limited, it means that there is an existing woodfuel supply infrastructure in place. This has a potentially key role in facilitating other developments such as woodfuelled heating or CHP which are looked at below. In addition, there *are* opportunities for the private sector to supply FibroThetford if the supply chain for material from this source can be further developed.

Case study: woodfuel production at Hall Farm, Garboldisham, Norfolk

Hall Farm is an arable farm of 242 hectares, located 9 miles to the west of Thetford in Norfolk. In common with other farms in the area, shelterbelts have been established to reduce wind erosion of the light soil and to provide cover for game birds, rental of the shoot to a local syndicate providing a modest annual income from the woodlands.

The site was identified and the owner contacted by the Woodland Assessment Project (WAP) undertaken by Anglia WoodNet in 2001. The owner expressed an interest in bringing the woodlands into active management to which end a Woodland Grant Scheme (WGS) application was prepared by the Forestry Officer for Norfolk County Council.

[52] One impact of this, for example, is that the development of a SRC producer group in the region (Anglia EnCrops) is largely stalled. Set up specifically to supply the Novera plant, but against the back-drop of the then level of wider activity, the group exists but is unlikely to grow substantially in the medium-term, dealing a blow to ambitions to see large-scale deployment of energy crops in the region.

The woodlands

The woodlands are divided into 12 blocks ranging in size from 0.12 to 3.80 ha and cover a total of 16.74 ha. The majority of the plantings date from 1953 to 1964 and consist of a mixture of conifer and broadleaved species. Naturally regenerated broadleaved trees of coppice and self seeded origins are present throughout, presumably encouraged by low levels of post planting maintenance. No management of the woodlands had taken place since the gales of 1987 and virtually no thinning had been done since planting.

The WGS prescribed a thinning to improve the quality and vigour of the trees, and to prevent the conifer element from suppressing the broadleaved species. The thinning would also stimulate development of ground flora and of a shrub layer and under-storey within the woodlands, thus increasing both the environmental value of the woodlands and their capacity to hold game birds. However, prior to being approached by a woodfuel contractor, the small scale of the operation and the cost of harvesting low grade roundwood resulted in the owner being unable to find a contractor who could carry out the thinning and provide a positive financial return.

The woodfuel operations

Wood-energy company Econergy Ltd operate a highly versatile mobile chipping unit (the *Surefire* Harvester), comprising a front mounted forestry chipper, a seven-meter timber grab and a 10m^3 capacity high tip bin, all mounted on a 214 hp Unimog on/off road base unit. The Surefire is capable of chipping in the wood and can travel at 55 mph on roads between small blocks of woodlands. Econergy contacted the owner via Anglia WoodNet and agreed terms for undertaking the thinning work based on purchase of the standing material.

A local forestry contractor was engaged by Econergy to carry out the thinning. The harvester cut sawlogs and fencing bars from the larger stems, which were extracted to roadside and sold. Subsequent to the removal of solid products, the remaining poorer quality stems and tops were left un-snedded in the racks to reduce in moisture content prior to in-wood chipping.

In total, c.270 tonnes of solid product were produced and c.600 tonnes of woodfuel was chipped for supply to FibroThetford. As a direct result of these operations the 17ha of woodland were returned to positive management, the owner received a positive financial return from an otherwise unprofitable operation and substantial employment (c.35% of a man-year) was generated.

Action points

The main actions indicated by the above relate particularly to the need for further development / refinement of the supply chain if greater volumes of material from the private sector are to find their way into the existing woodfuel market for FibroThetford. Some work to look at this has already been undertaken by the Forestry Commission, who have commissioned a report *Proving of Woodfuel Harvesting in Undermanaged Woodlands in the East of England*[53].

This report focuses on technical aspects of woodfuel harvesting and related logistics, making a number of recommendations for future work relating to felling systems, in-wood logistics, passive drying and other technical issues. However, there are also parallel issues that need to be addressed within a somewhat wider framework, including:

- a lack of detailed knowledge about much of the resource and it's ownership (confirmed by the recent *Woodland Assessment Project* undertaken by Anglia WoodNet) leading to high costs of procurement for woodfuel contractors, and also meaning that many owners are never apprised of the opportunities available;
- a lack of experience of forestry operations *per* se among many owners and of woodfuel operations even among those owners with forestry experience, leading to a degree of uncertainty and some perception of risk on their part;
- a lack of experience of woodfuel operations among contractors, leading again to a degree of uncertainty and a perception of risk.

Taken together, these suggest that a concerted approach is required, including:

a) continued support for technical development within the supply chain, most appropriately led by the Forestry Commission, with involvement of the Technical Development Branch (TDB) and with the private sector;

b) ongoing improvements to the quality of information available about the resource and its ownership, potentially building on the high quality of basic data now available through the Woodland Inventory via, for example, a GIS based system;

c) improved information flows within the sector (owners, contractors and professionals), including dissemination of best practice via information notes, demonstrations and so-on.

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53 Unpublished report by Econergy Ltd 2002.

Financial support for some of these activities may be available from a number of sources, including the DTI R&D programme as well as regionally held funds (for example from EEDA).

4.3. Woodfuelled heating - an emerging opportunity

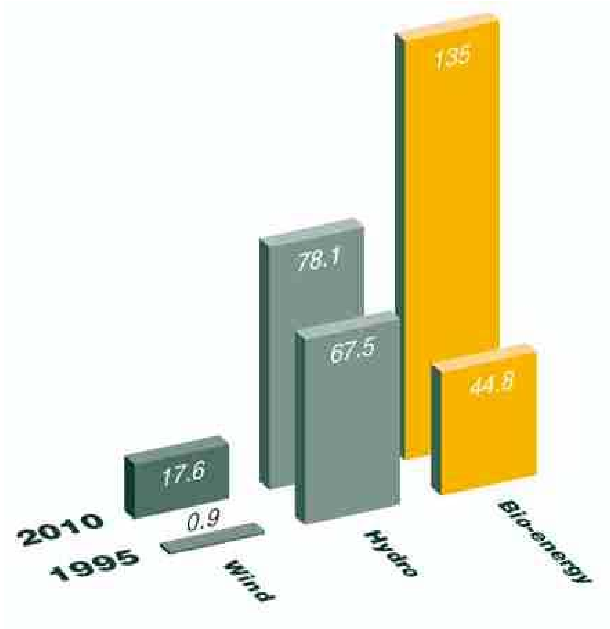
Introduction

For the next several years, the largest market in the East of England will remain the demand for woodfuel created by the FibroThetford electricity generating plant (see Section 4.2). However, for the reasons given above, this 'bulk' woodfuel market is likely to remain relatively static in the region for the medium term at least. In contrast, the development of smaller scale, localised wood heating plants such as that at the EcoTech Centre in Swaffham holds out the potential for very substantial growth, with additional potential for Combined Heat and Power (CHP) in appropriate circumstances (see note below).

Biomass heating in Europe

Despite a relatively low level of awareness, biomass energy represents the largest single source of renewable energy globally.

Biomass (primarily wood) heating alone accounted for almost 50% of all renewable energy in the EU in 1995 and is expected to account for 46% of the total growth of all renewable energy in the EU between 1995 and 2010 (source: European Commission). In the UK, heating and process fuels account for 45% of primary energy use.



Right: European Commission projections for renewable energy in Europe (Millions of tonnes of Oil equivalent)

It is certainly the case that in those European countries where energy from wood is already integrated into the energy supply infrastructure, the largest proportion of woodfuel is used to generate heat. Indeed, countries including Denmark, Sweden, Finland, Austria, Germany, France and Switzerland have generally followed a well rehearsed path: (pto)

The development of wood energy in continental Europe:

Traditional use of woodfuel (logs) in individual houses →

→ improved boilers for households, including introduction of wood-chip boilers →

→ development of localised community heating or district heating networks served form central boilerhouses with wood-chip boiler plant; development of CHP in large process applications (particularly paper mills and similar) →

→ CHP added to district heating networks (still rare) →

→ stand-alone electricity generation and / or co-firing considered (still extremely rare) →

→ advanced conversion technologies (gasification, pyrolysis) considered for large-scale stand-alone generation (none operating commercially in Europe).

Thus it is that wood heating rather than electricity production or even CHP accounts for almost half of all renewable energy production in the EU (see inset in Section 2.1 above). Only in the UK has the attempt been made to sidestep this trend, seeking to kick-start the industry by developing large-scale electricity generating plant without a pre-existing infrastructure of smaller-scale, much more embedded woodfuel use[54]. Albeit rather belated, there has now been an acknowledgement of the role that such smaller scale developments have to play and specific support developed for them (see Section 4.1).

While the size and fuel requirement of individual heating plants are substantially less than for electricity generating plant, projects of this kind are far more readily achievable and can be realised over a much shorter time frame, so that for the first time the opportunity properly exists to create a 'bottom-up' woodfuel industry which can mature rather more naturally. Moreover, the market for heating and process fuels is actually larger than that for electricity in the UK, accounting for approximately 45% of total energy use.

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[54] The route adopted in the UK during the 1990's was arguably difficult to achieve *per se*, but was exacerbated by the emphasis on what are essentially pre-commercial 'advanced conversion technologies' and on energy crops. In combination, these have effectively stalled the industry. An example is the Novera project at Eye which at one time appeared to hold out considerable potential, but which remains stalled and effectively dead nearly 10 years after securing a NFFO-3 contract (see 4.2 above).

Note regarding CHP

CHP is widely talked of almost as a given in the context of woodfuel development. However, achieving viable projects in practice is relatively difficult for a number of reasons:

1. Economics: the cost of woodfuelled CHP plant is substantially greater than for LPHW boiler plant (by a factor of perhaps 5 - 10:1), yet few technologies will yield even 20% electrical output (gasification promises more, one of its main attractions, but is technically unproven - see below). The justification for ***bona fide*** CHP (i.e. where there is a genuinely substantive thermal requirement) is often therefore difficult since the additional cost of the installation is rarely merited by the additional value of the relatively small fraction of electricity yielded.

2. Technology: at the very small scale ($<500kW_e$) conventional steam cycle generation plant tends to be relatively low efficiency and much store has be placed on gasification technology to make this scale viable (so-called 'downdraft' gasifiers at this scale). However, achieving this is technically challenging at it has at best had a somewhat patchy track-record. Commercially viable plant (ie. reliable, without unacceptable downtime or very high maintenance costs and with achievable feedstock requirements) remain to be proven, although a number of suppliers continue to attempt to bring a product to market.

   Other technologies, including micro-turbines and Stirling engines, are also under development, but none are yet commercially available. At a larger scale, proven technologies are commercially available, whether steam-cycle or more innovative (for example the Organic Rankine Cycle turbines that have been developed for biomass applications by Turboden in Italy[55]), but the economics of such schemes remain difficult.

In summary, woodfuelled CHP is not *impossible* to achieve in the UK, but it's application is limited. One particular context where it is believed likely that examples will develop is in the waste wood sector, where the relatively low cost of the feedstock (particularly if produced on-site) can substantially improve the economics for technically sound plant. However, it is likely that often it will be the value of the electrical sales that are the main driver in this context, with the heat secondary.

Bi▶re in Switzerland, where a $300kW_e$ ORC turbine and wood boiler provide CHP for a barracks and local village.

[55] See www.turboden.com.

4.4. Development potential

As indicated in Section 2.1, woodfuel or other biomass is uniquely placed among renewables to achieve market penetration into the heating and process fuels sector as a low carbon, renewable fuel. In a great many instances, simply substituting woodfuelled heating for fossil-fuelled heating will substantially over-achieve carbon-emission reduction targets, whether for a household, a school, a hospital or a factory. In addition, following such a course offers an extremely cost-effective route to achieving such reductions: woodfuelled heating is probably *the* lowest cost of all renewables both in terms of capital intensity / capital cost and in terms of delivered energy costs, as the tables set out below illustrate:

Fuel type	Fuel price	Units	Fuel price p/kWh	Saving p/kWh
Wood @ 35% mc (equiv £23/t @ 50% mc)	30.00	£/tonne	0.91	n/a
Heating oil	18.5	p/litre	1.90	0.99
Natural gas (commercial)	1.25	p/kWh	1.25	0.34
Natural gas (domestic)	1.7	p/kWh	1.7	0.79
Tanked gas	20.0	p/kg	2.32	1.41
MFO	13.5	p/litre	1.27	0.36
Coal	55.00	£/tonne	0.86	-0.05
Electricity (off peak domestic)	3.0	p/kWh	3.00	2.01
Electricity (peak domestic)	6.0	p/KWh	6.00	5.01

Table 4.1: Woodfuel equivalent energy costs compared to fossil fuels

Internal value = p/kWh		Moisture content - % (wet basis)					
		25	30	35	40	45	50
Fuel price - £/t	20	0.51	0.56	0.61	0.67	0.75	0.85
	25	0.64	0.70	0.76	0.84	0.94	1.06
	30	0.77	0.84	0.91	1.01	1.12	1.27
	35	0.90	0.98	1.07	1.18	1.31	1.48
	40	1.03	1.12	1.22	1.34	1.50	1.69
	45	1.16	1.25	1.37	1.51	1.69	1.90
	50	1.29	1.39	1.52	1.68	1.87	2.11

Table 4.2: Comparative energy costs for woodfuel at varying price and moisture content

RE technology	Capital cost - £ million / Megawatt installed capacity	Conversion efficiency
Wood boiler plant - LPHW	0.15 - 0.2	>70%
Wood boiler plant - steam	0.25 - 0.3	>70%
Wood CHP (<2MWe)	1.75 - 2.5	85-90%
Wood electricity generation, steam cycle >10MWe	1.4 - 2.0	30-34%
Wood electricity generation, CCGT gasification >30MW	1.75 - >2.5	35-38%
Wind medium scale on-shore, <5MWe	0.7 - 0.9	n/a
Wind large-scale off-shore >30MW	1.0 - 1.2	n/a
Photovoltaics	>4.5	n/a

Table 4.3: RE technology capital costs and comparative conversion efficiencies[56]

As Table 3.1 shows, woodfuel is lower cost than most fossil heating fuels at current prices, and as fossil fuel costs rise[57] so the competitiveness of energy from biomass continues to get better. However, it is important to note that the costs given in the Table and also in Table 4.2 (in pence per kilowatt-hour) do not translate straightforwardly into a direct comparison with the overall cost of fossil-fuelled heating. This is because these figures relate to the equivalent cost of energy inputs but take no account of capital costs.

The latter are a key component in the overall cost of woodfuelled heating, which is based upon a relatively straightforward economic model, viz. capital costs are higher than conventional fossil-fuelled plant but running costs (mainly fuel) are lower ∴ savings on running costs generate a 'payback' on the additional capital. This implies three key sensitivities which impact on the viability of any scheme:

1. Capital cost - relatively inelastic in a given context; major variables include cost of fuel reception / storage / handling facilities, also steam plant (for process applications) is significantly more costly than LPHW (Low Pressure Hot Water) plant; other than very small-scale (domestic) systems, which can be relatively low cost *pro rata* for their size, there is generally strong cost-decay with scale.

[56] Note: wood boiler efficiencies are 'seasonal', ie. average efficiencies - spot efficiencies will be >80%.

[57] Although fossil fuel prices will always fluctuate, in the medium to long term the trend is clearly upward due to a combination of higher world prices and rising UK taxation on fossil fuel energy. Oil prices are notoriously volatile but are generally recognised to be on an upward trend. Gas prices are far more stable but have risen significantly in the UK during 2000-2002 and are currently forecast to rise by 12% over the next 5 years in addition to any tax increases such as CCL (Commercial Brief, Lattice Energy Services, April 2002). See also www.dti.gov.uk/energy/inform/index for energy statistics.

2. Fuel cost - depends upon fuel source and supply chain; generally follows a cost hierarchy (lowest to highest) of clean woody waste ➔ forestry derived woodfuel ➔ energy crops (SRC); clean waste fuels can be very low cost if they accrue PRN's making them a key mechanism for competing with natural gas (see also below)[58]; transport is often the largest single cost in the supply chain and local supply and efficient logistics are key to providing woodfuel cost-effectively.

3. Utilisation - often expressed as *full load equivalent hours per year*, ie. the equivalent running time of a boiler at it's maximum rated output over a year (max. 8,760 hours); this is an essential component of the overall economics since, however low cost the fuel, it will not generate a payback if demand is low - the more a woodfuelled boiler is used, the greater the savings that will accrue and the more cost-effective it will be; for this reason it is not often cost-effective to size wood boiler plant for 'peak' loads which may happen for only a few hours per year (design criteria for the East of England for estimating peak heating load is -3.1C external temperature while maintaining comfort conditions internally (18-21C according to use)) so that many applications will be 'hybrid' systems incorporating a peak / standby fossil fuelled boiler with the aim of maximising fuel substitution by the wood boiler.

As indicated in Table 4.3, biomass heating is perhaps *the* least capital intensive of any RE technology and delivered energy costs, taking into account both capital and revenue costs, are indeed among the lowest of all renewables. However, while they are competitive with fossil fuels in a number of market segments, fossil fuels are still comparatively cheap in the UK[59] and it is important to recognise that promotion and marketing of woodfuelled heating must be carefully targeted if successful market penetration is to be achieved.

Target markets

There is no doubt that the relatively low cost of natural gas, particularly for non-domestic consumers, makes it difficult for woodfuelled heating to compete in many circumstances. This is not to say that woodfuelled heating cannot compete with gas under *any* circumstances,

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[58] PRN's (*Packaging Recovery Notes*) are a tradeable commodity so that their value fluctuates. However, the value of PRN's for wood-based packaging have been very high - up to £25-30 per tonne.

[59] By way of comparison, fuel oil in Denmark, where there is a very well developed bioenergy market, is approximately 45 pence per litre, ie. approximately 2-2 1/2 times the cost in the UK. The difference in cost is accounted for by duty arrangements - fuel oil for heating has the same duty as diesel for transport, making the latter comparatively lower cost in Denmark. Overall, Danes would expect to pay c.4.5 - 5 p/kWh for heat (many of them buy heat from community heating schemes), substantially more than in the UK, in which context woodfuelled heating is extremely competitive.

but taking the three sensitivities outlined above it will generally be competitive on larger sites with a good level of utilisation and using a low delivered cost source of woodfuel. Such sites might include hospitals or glasshouses or university campuses, for example. Nevertheless, it must be acknowledged that there are many sites where this does not apply and the low cost, widespread availability and relative ease of use of natural gas are probably the largest single constraint on uptake of woodfuelled heating.

Case study: wood heating at the EcoTech Centre and Business Park

A 250 kW fully automatic woodfuelled boiler at the EcoTech Centre in Swaffham, Norfolk provides heat and hot water to the Centre and the 15 units on the neighbouring Business Park. Operation, maintenance and fuel supply are all provided by specialist wood energy company Econergy Ltd under an eight-year **ecoheat** renewable energy supply contract. Renewable Heat is sold to EcoTech at a tariff competitive with energy from fossil fuels.

The EcoTech boilerhouse (foreground, Centre behind) Units on the EcoTech Business Park

In contrast, the market segments in which biomass heating is most competitive and most appropriate are generally energy users in rural or rural fringe areas using heating oil or other relatively more costly fuels (see also below for a review of gas availability in the Region). While this represents a limited part of the overall market it is nevertheless an enormous market opportunity[60]. Types of sites / end-uses that offer the greatest potential, all of which are to be found within the region, include[61]:

- process heat users, including food processors
- horticulture (glasshouses)
- community heating, primarily in new-build developments
- higher education campuses
- armed forces bases, prisons
- hospitals and nursing / care homes
- leisure centres
- retail complexes, distribution centres
- hotels
- schools
- rural estates and farms

The gas network in the East of England

BRE data shows that in 1996 63% of rural households, including those in rural towns, used mains gas or LPG[62], compared to 83% of all households. The remainder were split between fuel oil (12%), solid fuel (9%), standard rate electricity (2%), off-peak electricity (8%) and other fuels (6%). The use of gas generally declines with increased isolation: 55% of village centre households use gas, but only 31% of isolated rural households do so. Similarly, a survey of rural services in England undertaken by the Rural Development Commission in 1994[63] showed that

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[60] Market research commissioned by ETSU (*The Market from Wood Chips from Coppicing: A Report*, FDS Market Research Group Ltd, for ETSU (unpublished), December 1993) estimates that, in addition to 7.6 million rural dwellings and 240,000 major farm holdings, there are 564,000 rural business and service premises in the UK. Detailed market research by British BioGen, trade association for the biomass sector, indicates that the total boiler capacity in core target sectors (excluding process heat users) is in excess of 20,000 MW_{th}, with boiler replacement sales alone estimated to be 1,300 MW_{th} / year.

[61] Note: as well as heating (space heating, process heat and DHW (Domestic Hot Water), it is also technically possible to provide cooling and even refrigeration from a wood boiler via an *absorption chiller*. The cost of such plant and it's relatively low CoP (coefficient of performance) compared to conventional chiller plant limit the application of this technology but the same sensitivities apply as to heat (capital cost, fuel cost, utilisation) and potential end-uses do undoubtedly exist.

[62] Source *Report of the Working Group on Extending the Gas Network*, DTI 2001 (www.dti.gov.uk/energy/gas_and_electricity/trading_networks/gasnetreport.pdf). Mains gas use and LPG use were recorded together in the BRE data, which was primarily concerned with boiler technology. A substantial majority of households thus recorded will use mains gas (LPG use is rather less than that of heating oil).

[63] *1994 Survey of Rural Services*, Rural Information Series, The Rural Development Commission, 1995.

over 50% of rural parishes had no mains gas connection while only 8% had a full gas connection.

A working group was set up by the DTI in 2000 to look at extending the gas network as a way of helping to alleviate fuel poverty. The study undertook a cost-benefit analysis of extending the gas network, looking at other energy sources and the range of energy efficiency schemes available. Based on requests to Transco for connections (so that the figures are likely to represent an underestimate), the working group found that there are over 4000 communities of more than 150 dwellings in England without access to the gas network, of which over 1300 are of more than 300 dwellings, and over 100 of more than 750. These communities are overwhelmingly rural. Almost 1300 are within 2km of an existing gas main, over 2200 between 2 and 7km of a main; and over 500 more than 7km from a main.

The East of England has the second highest number of communities of greater than 150 dwellings not connected to the network (second after the Southwest), with 729 settlements not connected (238 are within 2km of a gas main, 440 within 2-7km and 51 are >7km from an existing main).

As a rule of thumb, the average cost of providing a connection is £100 per metre and £400 per household, and the findings of the working group's report suggested that the extension of the gas network rarely offered value for money. It is only likely to be appropriate for communities where a number of key criteria (size of community, density and clustering of houses, relatively close proximity to the existing network) coincide. These will be relatively limited and in the light of this there is a large (predominately rural) population that is not and is not likely to be connected to mains gas.

In this context, the report recognises the role that renewables could play in addressing the energy needs of these communities. Woodfuel is perhaps the most obvious option to pursue in this regard, and, conversely, those communities without access to mains gas are a natural target for penetration by woodfuelled heating.

Fuel Poverty in England

The formal definition of a fuel poor household is one that has to spend in excess of 10% of household income to achieve a satisfactory heating regime (defined as 21°C in the living room and 18°C in the other occupied rooms)[64]. The UK Fuel Poverty Strategy gives estimates of the number of households in fuel poverty in England, summarised in the Table below:

64 *The UK Fuel Poverty Strategy*, DTI 2001 (www.dti.gov.uk/energy/consumers/fuel_poverty/strategy).

Year	Income inc Housing Benefit & ISMI	Income exc Housing Benefit & ISMI
1998	3.3	4.5
1999	3.1	4.2
2000	2.8	3.9

Table X: Number of households estimated to be in fuel poverty in England (millions)[65].

Based on the 1998 figures the Eastern region accounted for 9.7% of the total fuel poor in England, representing 14.6% of homes in the region. The study suggests that different approaches are needed to address fuel poverty in different regions to reflect the particular circumstances of the area.

Methods for addressing fuel poverty include increasing the energy efficiency of properties, reducing fuel bills and tackling low incomes and unemployment. One recognised way of tackling fuel poverty is developing Community Heating, linking a number of dwellings to a central boiler plant (sometimes with CHP) and making individual boilers unnecessary. Woodfuelled heating is potentially well suited to such applications where they are remote from the mains gas network. Thus it is that the strategy recognises the potential role renewable energy can play in addressing fuel poverty, and indicates that in the context of energy poverty 'the government intends to carry out a £5 million pilot to test a range of renewable energy and related technologies for use in homes that are off the mains gas network'.

Gas within the RPA's

It was hoped that the population without access to mains gas could be readily identified, particularly for the RPA's. However, Transco have no generally available records of where gas goes off the main distribution network. A study was therefore undertaken to attempt to give some indication of this population through a survey of parish councils in the Norfolk RPA. Each council was written to and asked to summarise the energy sources available within the parish.

47 of the 328 parishes in the RPA replied, equivalent to just under 15%, which is regarded as a reasonable return rate. Of these, 43, or 91.5%, have no access to mains gas, with just 4 (8.5%) indicating that they do have such access, and just 2 indicating that they had 76-100% availability. It is acknowledged that there is a degree to which the parishes that made returns may have been self-selecting, i.e. that a disproportionate number without mains gas were moved to respond. However, there is no doubt that a very substantial majority of the parishes in the RPA do lack mains gas, with all that this can entail in terms of costly and often

65 *Fuel Poverty in England in 1999 and 2000*, January 2002, DTI and DEFRA; the 1998 figures are based on the 1998 Energy Follow up Survey (EFUS) to the English House condition Survey; the 2000 and 1999 figures are broad estimates taking account of changes in fuel prices and incomes and using the 1998 EFUS results as the baseline.

inadequate or inconvenient heating for those living there. This dovetails well with the wider emphasis which is accorded to these parishes for diversification / rural regeneration and makes them a natural target market for woodfuelled heating (see also 4.3.7, below).

Costed scenarios

In order to contextualise the competitiveness of woodfuelled heating, crucial to achieving substantive market penetration, a number of illustrative examples comparing the cost of installing and operating wood boiler plant with conventional plant are set out below. The main inputs are relatively self-explanatory and have been set based on the author's experience. It is important to note, however, that they are illustrative only and are in no sense intended to be definitive – a number of the key variables are very sensitive, having a significant impact on the overall 'shape' of the cost-benefit, and every site and every context is different in this respect.

Key variables include:

- Boiler output - MCR = *maximum combustion rate*, ie. maximum output.
- Capital cost - expressed as a total cost and also as an equivalent cost per kilowatt of installed capacity in order to give a comparator.
- Grant rate - a flat rate of 25% is assumed for wood boiler installations, which is essentially in line with the rates of grant under the Bio-energy Capital Grant Scheme or the Community and Household Scheme, although the paybacks for the different competing fuel types are also given without grant aid.
- Fuel moisture content (mc) - the net calorific value (cv) of woodfuel has a straight-line relationship with mc, so that this is an essential input; as importantly, the fuel moisture content must tie up with the boiler / combustor specification; the moisture content is given as the percentage of water in the fuel (by weight) on a *wet basis* (the standard measure in the bio-energy industry and the most intuitively understandable, although note that much of the joinery industry works on moisture content expressed on a *dry basis*).
- Boiler seasonal efficiency - although 'spot' efficiencies at full output will be relatively high (>80% for most boilers, whether woodfuelled or conventional), the seasonal efficiency indicates the average efficiency over the whole heating season, allowing for standing losses and so-on; the cost of the woodfuel divided by this factor gives the effective cost of useful *heat.*
- Woodfuel cost - expressed as a cost per tonne at the given moisture content and an equivalent cost per *oven dry tonne* (odt), i.e. at a notional 0% moisture content.

- Conventional fuel cost - expressed in units appropriate to the fuel; note that non-domestic gas prices include the CCL.
- Full load equivalent hours - relates to the level of utilisation of the boiler and equates to the equivalent number of hours (out of 8,760 in a year) that the boiler would run at full output over a year (recognising that it will actually run for more hours but at varying outputs).

These inputs produce a number of 'bottom line' results, including:

- net capital cost of wood boiler installations and cost / kW of installed capacity (a useful comparator)
- annual running cost of wood and fossil-fuelled plants in £'s and in equivalent p/kWh
- annual savings accrued by using woodfuel
- simple payback on the cost of woodfuelled boiler plant based on the annual savings (with and without grant aid)

Example 1: 'small-scale' / domestic heating, e.g. large farmhouse

Wood boiler capital				
Boiler output @ MCR			40	kW
			136,560	btu
Approx fuel use @ MCR			0.09	m3 per hour
Total capital cost			10,000	£
Pro-rata capital cost			250	£/kW capacity
Grant aid	@	25.0%	2,500	£
Net capital cost			7,500	£
Woodfuel costs &				
Moisture content			35	%
Boiler seasonal			65.0%	
Effective output			2,132	kWh/tonne
Input cost of woodfuel			20.00	£/tonne
			30.77	£/odt
Effective cost of woodfuel / unit			**0.94**	**pence / kWh**
Full load equivalent hours			1,800	hours per year
Energy produced /year			72,000	kWh
Fuel used /year			34	tonnes
			22	odt's
Fuel cost /year			**675**	**£**
Maintenance cost			**150**	**£ / annum**
			0.21	**pence / kWh**
Total annual heating			**825**	**£**
Cost /unit heat			**1.15**	**pence / kWh**

Comparators:

Heating oil		
Boiler costs & fixed costs		
Output @ MCR	40	kW
	136,560	btu
Installed capital cost	3,500	£
Fuel costs & useage		
Energy content	35	mj/ l
Boiler seasonal effy.	70%	
Output	6.8	kWh/ l
Cost of oil	18.5	pence / litre
Cost / unit heat	**2.72**	**pence / kWh**
Full load equivalent hours operation	1,800	
Energy produced / year	72,000	kWh
Fuel used / year	10,580	l
Fuel cost / year	**1,957**	**£**
Maintenance cost	**75**	**£ / annum**
	0.10	**pence / kWh**
Total annual heating costs	**2,032**	**£**
Cost / unit heat	**2.82**	**pence / kWh**
Annual saving	**1,207**	**£**
Simple payback on exta capital	**3.3**	**years**
Payback without grant	5.4	years

Natural gas		
Boiler costs & fixed costs		
Output @ MCR	40	kW
	136,560	btu
Installed capital cost	2,750	£
Fuel costs & useage		
Boiler seasonal effy.	70%	
Cost of gas	1.50	pence / kWh
Cost / unit heat	**2.14**	**pence / kWh**
Full load equivalent hours operation	1,800	
Energy produced / year	72,000	kWh
Fuel used / year	102,857	kWh
Fuel cost / year	**1,543**	**£**
Maintenance cost	**75**	**£ / annum**
	0.10	**pence / kWh**
Total annual heating costs	**1,618**	**£**
Cost / unit heat	**2.25**	**pence / kWh**
Annual saving	**793**	**£**
Simple payback on exta capital	**6.0**	**years**
Payback without grant	9.1	years

Tanked gas		
Boiler costs & fixed costs		
Output @ MCR	40	kW
	136,560	btu
Installed capital cost	3,500	£
Fuel costs & useage		
Energy content	31	mj/ kg
Boiler seasonal effy.	70%	
Output	6.0	kWh/ kg
Cost of gas	20.00	pence / kg
Cost / unit heat	**3.32**	**pence / kWh**
Full load equivalent hours operation	1,800	
Energy produced / year	72,000	kWh
Fuel used / year	11,945	kg
Fuel cost / year	**2,389**	**£**
	75	**£ / annum**
	0.10	**pence / kWh**
Total annual heating costs	**2,464**	**£**
Cost / unit heat	**3.42**	**pence / kWh**
Annual saving	**1,639**	**£**
Simple payback on exta capital	**2.4**	**years**
Payback without grant	4.0	years

Commentary:

This scenario is based on a 'self-supply' model, ie. production of woodfuel on-site by, for example, a farm, and the relatively low woodfuel cost used reflects this (although much even of this cost will be internal within the enterprise and will very often be at marginal cost). Note that the type of boiler plant assumed requires ‘seasoned’ fuel (<35% mc), which requires summer drying ‘in the round’ prior to winter use. It also has a lower efficiency than larger, more sophisticated wood boiler plant, although it will nevertheless burn cleanly at a quite acceptable level of efficiency.

The overall results show that substantial savings on running costs are possible compared to the most likely alternative fuels - heating oil, natural gas (mains gas) or tanked gas. While, it is clearly difficult to achieve a viable payback when compared to the cost of a natural gas system, against both oil and tanked gas these savings are sufficient to give what would generally be regarded as a viable payback, i.e. in the region of 2-4 years. However, the importance of grant aid in achieving this is clear.

The usual sensitivities apply, i.e. capital cost, grant rate, woodfuel cost, utilisation and competing fuel costs.

Example 2: 'medium-scale' heating, eg. community school or leisure centre

Wood boiler capital costs			
Boiler output @ MCR		500	kW
		1,707,000	btu
Approx fuel use @ MCR		0.97	m3 per hour
Total capital cost		100,000	£
Pro-rata capital cost		200	£/ kW capacity
Grant aid		25,000	£
	@ 25.0%		
Net capital cost		75,000	£
Woodfuel costs & useage			
Moisture content		50	%
Boiler seasonal effy.		77.5%	
Effective output		1,833	kWh/ tonne
Input cost of woodfuel		24.00	£/ tonne
		48.00	£/ odt
Effective cost of woodfuel / unit heat		**1.31**	**pence / kWh**
Full load equivalent hours operation		2,200	hours per year
Energy produced / year		1,100,000	kWh
Fuel used / year		600	tonnes
		300	odt's
Fuel cost / year		**14,402**	**£**
Maintenance cost		**350**	**£ / annum**
		0.03	**pence / kWh**
Total annual heating cost		**14,752**	**£**
Cost / unit heat		**1.34**	**pence / kWh**

Comparators:

Heating oil		
Boiler costs & fixed costs		
Output @ MCR	500	kW
	1,707,000	btu
Installed capital cost	35,000	£
Fuel costs & useage		
Energy content	35	mj/ l
Boiler seasonal effy.	70%	
Output	6.8	kWh/ l
Cost of oil	18.5	pence / litre
Cost / unit heat	**2.72**	**pence / kWh**
Full load equivalent hours operation	2,200	
Energy produced / year	1,100,000	kWh
Fuel used / year	161,633	l
Fuel cost / year	**29,902**	**£**
Maintenance cost	**250**	**£ / annum**
	0.02	**pence / kWh**
Total annual heating costs	**30,152**	**£**
Cost / unit heat	**2.74**	**pence / kWh**
Annual saving	**15,400**	**£**
Simple payback on exta capital	**2.6**	**years**
Payback without grant	4.2	years

Natural gas		
Boiler costs & fixed costs		
Output @ MCR	500	kW
	1,707,000	btu
Installed capital cost	30,000	£
Fuel costs & useage		
Boiler seasonal effy.	70%	
Cost of gas	1.25	pence / kWh
Cost / unit heat	**1.79**	**pence / kWh**
Full load equivalent hours operation	2,200	
Energy produced / year	1,100,000	kWh
Fuel used / year	1,571,429	kWh
Fuel cost / year	**19,643**	**£**
Maintenance cost	**250**	**£ / annum**
	0.02	**pence / kWh**
Total annual heating costs	**19,893**	**£**
Cost / unit heat	**1.81**	**pence / kWh**
Overall economics, wood vs gas		
Annual saving	**5,141**	**£**
Simple payback on exta capital	**8.8**	**years**
Payback without grant	13.6	years

Commentary:

This scenario is based on a typical medium-sized installation of the kind that might represent a largish secondary school or a leisure centre, ie. the kind of 'pioneer' sites that many local authorities are looking to develop. However, note that the level of utilisation assumed is relatively high (2,200 FLE hours / annum), commensurate with a leisure centre or with a school with a degree of 'out of hours' use such as a community school. This is a relatively key sensitivity for this kind of application - most schools occupied 8.30 - 3.30 five days per week during term-time only represent relatively poor heat loads.

The model assumes that woodfuel is supplied from a third party to a 'wet wood boiler' capable of burning fuel at 50% moisture content with a high level of efficiency[66]. While the level of grant aid is again key, the overall results show that substantial savings on running costs are possible compared to the most likely alternative fuels - heating oil or natural gas. Nevertheless, while this generates a good payback vs. oil, it is once again hard to compete against gas in a strictly commercial sense, although the concept of *lifecycle costings* is often adopted to provide a longer-term perspective of the value of such savings.

[66] The level of efficiency given is based on the type of fully modulating control using llamda sensors to monitor flue gas oxygen levels (and thereby combustion quality) that is now standard on state-of-the-art wood boiler plant.

Example 3: 'large-scale' heating, e.g. hospital or university campus

Wood boiler capital costs			
Boiler output @ MCR		2000	kW
		6,828,000	btu
Approx fuel use @ MCR		3.90	m3 per hour
Total capital cost		270,000	£
Pro-rata capital cost		135	£/ kW capacity
Grant aid		67,500	£
	@ 25.0%		
Net capital cost		202,500	£
Woodfuel costs & useage			
Moisture content		50	%
Boiler seasonal effy.		77.5%	
Effective output		1,833	kWh/ tonne
Input cost of woodfuel		22.50	£/ tonne
		45.00	£/ odt
Effective cost of woodfuel / unit heat		**1.23**	**pence / kWh**
Full load equivalent hours operation		3,500	hours per year
Energy produced / year		7,000,000	kWh
Fuel used / year		3,819	tonnes
		1,909	odt's
Fuel cost / year		**85,920**	**£**
Maintenance cost		**2,000**	**£ / annum**
		0.03	**pence / kWh**
Total annual heating cost		**87,920**	**£**
Cost / unit heat		**1.26**	**pence / kWh**

Comparators:

Medium fuel oil (MFO)		
Boiler costs & fixed costs		
Output @ MCR	2,000	kW
	6,828,000	btu
Installed capital cost	85,000	£
Fuel costs & useage		
Energy content	38.17	mj/ l
Boiler seasonal effy.	75%	
Output	8.0	kWh/ l
Cost of oil	13.50	pence / litre
Cost / unit heat	**1.70**	**pence / kWh**
Full load equivalent hours operation	3,500	
Energy produced / year	7,000,000	kWh
Fuel used / year	880,272	l
Fuel cost / year	**118,837**	**£**
Maintenance cost	**1,800**	**£ / annum**
	0.03	**pence / kWh**
Total annual heating costs	**120,637**	**£**
Cost / unit heat	**1.72**	**pence / kWh**
Annual saving	**32,716**	**£**
Simple payback on exta capital	**3.6**	**years**
Payback without grant	5.7	years

Natural gas		
Boiler costs & fixed costs		
Output @ MCR	2,000	kW
	6,828,000	btu
Installed capital cost	75,000	£
Fuel costs & useage		
Boiler seasonal effy.	75%	
Cost of gas	1.20	pence / kWh
Cost / unit heat	**1.60**	**pence / kWh**
Full load equivalent hours operation	3,500	
Energy produced / year	7,000,000	kWh
Fuel used / year	9,333,333	kWh
Fuel cost / year	**112,000**	**£**
Maintenance cost	**1,200**	**£ / annum**
	0.02	**pence / kWh**
Total annual heating costs	**113,200**	**£**
Cost / unit heat	**1.62**	**pence / kWh**
Annual saving	**25,280**	**£**
Simple payback on exta capital	**5.0**	**years**
Payback without grant	7.7	years

Commentary

This scenario is based on a relatively large installation with a high level of utilisation of the kind that might represent a hospital or a university campus. This high level of utilisation coupled with the economies of scale that can be achieved for large wood boiler plant (particularly *pro rata* capital cost, but to a lesser degree woodfuel costs also) mean that savings can still be made against the more likely alternative fuels in this instance - MFO (which is significantly lower cost than 35 second oil) or natural gas. While the payback periods are relatively longer, and the economics are indeed tight, paybacks stretching to nearer 5 years can be acceptable in these more commercial type scenarios where an Energy Service Company, for example, has access to loan capital with which to 'gear' or 'leverage' their returns over a relatively long time-frame. Grant aid is clearly essential, however.

Scenario modelling - summary

Once again, it is stressed that the scenarios set out are in no way intended to be definitive - in practice, each potential wood heating site has its own set of drivers and its own constraints and opportunities that can impact fundamentally on the costs and benefits. However, they *are* illustrative, and overall they show both some of the opportunities offered by woodfuel, ie. in being competitive with alternative fossil fuel costs in many rural areas, as well as the limitations entailed in attempting to compete with natural gas.

Note: all of the models generated are based on using forestry derived woodfuel. As indicated in Section 1, the use of clean waste wood for fuel is also an opportunity which, while not the focus of this report, cannot be ignored. Woodfuel at 20% moisture content delivered at £24 per tonne (by no means out of kilter with waste wood prices even without allowing for PRN's) gives an equivalent cost of heat of 0.74 p/kWh in the larger more efficient plant. Furthermore, while there are costs entailed in providing the flue gas monitoring required to meet emissions regulations when using such fuel, there are also savings to be made in being able to specify dry wood boiler plant. Thus, this type of material has a potentially important role to play in achieving market penetration in situations where forestry derived woodfuel struggles to be competitive (eg. against natural gas), in pump-priming the industry and in reducing aggregate net fuel costs by being used alongside forestry woodfuel or even energy crops.

Market barriers

Clearly, there are inevitable challenges entailed in offering energy that is not only renewable but also competitive in the wider energy market. However, with current fossil fuel costs set only to rise in the medium-term, there are also undoubted opportunities as the scenarios and the discussion set out above briefly elaborate. In combination with the positive fiscal and regulatory framework that is now in place, market conditions for the development of woodfuelled heating in the UK are now better than ever before and the scene has undoubtedly been set for substantial growth that could develop over a relatively short timespan.

However, a number of market barriers continue to inhibit development at the present time. Dealing with these issues will be critical to establishing a viable wood heating sector that is able to develop and grow, yet, significantly, many can be addressed at a regional or even sub-regional level. Thus, they are set out below together with a number of suggested actions that, taken together, are used to provide the core to an overall Action Plan that is set out in Section 5.

1. Undeveloped markets, both public and private sector.

In a sense, this sums up all of the issues together. The currently undeveloped nature of the market for woodfuelled heating becomes to a degree self-perpetuating - lack of critical mass results in lack of infrastructure, lack of awareness, lack of knowledge and skills, high costs and so-on. Therefore, the over-riding need is to promote market expansion and create a market base.

Actions:

a) Engage the public sector: driven more directly by UK government policy on emissions and with an immediate concern for economic regeneration, LA21 and so-on, the public sector has been shown to be a key catalyst in market development elsewhere in Europe; public sector managers should be strongly encouraged and assisted to consider woodfuelled heating as a viable option.

b) Prioritise other target markets likely to be 'early adopters'; market sectors that are likely to be receptive are:

   - The "Carbon Market" – private sector industrial energy users with CCA's and both public and private sector organisations participating in the ETS.
   - 'Self supply' farms and rural estates, forestry businesses etc.
   - Waste wood and wood processing industries (though less relevant to this report).

c) Use 'pioneer sites' to create clusters of sites and local critical mass. This is a clear role for the RPA's, where it would provide a good fit with the broader regeneration objectives that apply to these areas. The same also applies to the Community Forests, where it would provide a good fit with their strong educational / public communication role and could also potentially tie in to new planting by providing an outlet for early thinings or even energy crops.

d) Promote 'Energy Service Companies' (ESCO's) and 'Heat Entrepreneurs' (HE's)- see below.

2. Lack of fuel supply infrastructure (see also 4.2 above).

In the East of England this is in many ways less of a constraint that elsewhere in the UK due to the initial market for woodfuel generated by the FibroThetford power station. However, while this means that it is possible to specify or procure a wood boiler in parts of Norfolk and Suffolk with a degree of confidence that woodfuel is available (something that by no means applies in much of the country), the current situation nevertheless remains limiting:

- There is a clear lack of diversity, with only one large-scale woodfuel producer (MI Edwards Engineers of Brandon) and one smaller producer (Econergy Limited, based in Bedfordshire).
- Geographically, most activity is centred on the FibroThetford plant, for obvious reasons, and the operations run by MI Edwards in particular are very much focused on the FE

estate in Thetford Forest (Econergy operate rather more mobile plant but are the only contractor in the region to do so). In contrast, heating plant require highly local supplies in order to be economic.

- In developing local supplies, there is a lack of knowledge about the potential woodfuel resource, particularly in the 'undermanaged' sector, which is highly fragmented, with the result that procurement can be onerous and costly.

- Supply chains for the relatively distributed and smaller-scale requirements of heating plant are still not well developed and present challenges in terms of, for example, fuel quality (particularly moisture content), harvesting systems (there is a lack of experience on the part of conventional harvesting contractors of the systems of work required for woodfuel recovery, which can differ significantly from conventional roundwood harvesting) and logistics (particularly transport and the interface with on-site fuel reception / storage facilities).

Note: see also 4.2.

The key needs implied by these constraints are:

- To stimulate diversity, both geographically and in terms of scale of operations, by encouraging and facilitating new entrants.

- To improve our knowledge base relating to the resource.

- To prove supply chains that are appropriate to woodfuelled heating applications.

Actions:

Without doubt, the best stimulus for the creation of fuel supply chains is an expanding and viable market, ie. 'market pull'. This represents a very powerful driver and will draw in the private sector to fulfil the need, whether ESCO's, groups of farmers, existing forestry contractors or others (see below for the role of ESCO's). Nevertheless, there are additional actions that could significantly assist this process. A number are identified above in Section 4.2 (technical developments, improved knowledge and so-on). In addition to this, however, further actions in the context of facilitating the development of woodfuelled heating include:

a) Use the demand created by live projects to drive supply chain development.

b) Look at different models for developing localised supply infrastructure, e.g. owner-based via machinery rings or 'producer groups', and assist business creation, for example of vertically integrated ESCO's.

c) Provide grants to support plant and related purchases (for example storage facilities).

All of these could and should be linked to the concept of pioneer clusters identified above. Once again, the potential role of the RPA's and of the Community Forests in this regard is stressed and should be made a priority.

3. Lack of awareness on the part of end-users and specifiers.

Clearly, a lack of awareness on the part of the potential customer base is a fundamental obstacle to market growth. Increasing awareness is therefore vital if people and organisations are even to consider using wood to meet their energy needs. Beyond this, once aware of the opportunity, it is equally essential that end-users and specifiers know how to set about procuring either boiler plant, fuel and related services, or, perhaps more probably, how to engage a service provider (ESCO or HE). This entails improving market knowledge about 'who, what and where', but also instilling confidence in the procurement process in terms of value for money, technical robustness and so on.

Actions:

a) The profile of woodfuelled heating needs to be raised via co-ordinated and concerted actions:

- signposting people and organisations to sources of expertise;
- providing advice to end-users and specifiers, including feasibility studies;
- disseminating case studies and best practice;
- the role of the private sector in marketing the concept should also be acknowledged by providing mentoring and support to new ESCO's and HE's.

Again, a focused and concerted effort over clearly defined target areas with pre-existing and active stakeholder groups such as the RPA's and Community Forests is one mechanism for achieving this.

4. Lack of technical expertise in the form of those qualified to specify and install heating systems.

In many ways this is closely related to 3., above, and is a genuine constraint on effective procurement. Currently there is very limited experience with woodfuelled heating systems either among heating engineers or consulting engineers, and there have been some high profile problems with one or two of the pioneering demonstration sites elsewhere in the country and even within the Region[67]. It is essential that this is not replicated and both to avoid this and to facilitate procurement several actions should be taken.

Actions:

a) Assist professionals (architects, services engineers) in gaining knowledge of woodfuelled heating systems via advice and training, for example via a CPD (Continuing Professional Development) programme.

b) Encourage diversification of existing heating engineers / installers by providing focused training opportunities. The market does not require large numbers of such installers - initially it is most important that a core of competent and knowledgeable installers is developed[68].

c) Foster expertise within new ESCO's and HE's to ensure that they are able to provide an effective service and a local source of dedicated expertise.

5. High initial cost of wood boiler plant.

This is undoubtedly a constraint on growth. Wood boiler plant will always be more costly than conventional plant for definite technical reasons and it is accepted that the basic formula of higher capital costs paid for by lower running costs will remain. However, in the short-term costs are higher than they might be due to the lack of volume in the market. In the medium term there will undoubtedly be a degree of cost-decay as critical mass is achieved and volumes of sales increase. However, in the short term it is extremely important that this should be addressed (see also the costed scenarios provided above).

Actions:

a) Ensure that the various national schemes (Bi-energy Capital Grant Scheme and, more particularly, the Community and Household Renewables Scheme (*Clear-Skies*)) are effectively promoted.

b) Consider providing additional capital support via regional grant aid, perhaps targeted at pioneer sites and clusters and linked to the RPA's and Community Forests.

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[67] For example, the poorly specified and near-disastrous installation at the Forest Centre in the Marston Vale Community Forest (see also description of the Community Forests in Section 2.3).

[68] A limited (derived from the Yellow Pages) survey of heating engineers in Norfolk, Suffolk and Cambridgeshire elicited 12 responses. Of the respondents, 6 indicated that woodfuelled heating could be of interest to their customers and that they themselves had an interest in receiving specialist training. This implies a sufficient level of interest to make a sensibly scoped training programme viable with further, more pro-active promotion.

c) Offer support to ESCO's and HE's to assist them with drawing in private finance. Note: this is not a substitute for grant support.

Energy Service Companies and Heat Entrepreneurs

The role of so-called *Energy Service Companies* (ESCo's) and of *Heat Entrepreneurs* (HE's) is widely acknowledged as being one of the key mechanisms for achieving market penetration of wood heating in the UK. The essential concept behind both models is the same: rather than selling customers either wood boiler plant or woodfuel *per se*, the provider supplies a complete package of boiler installation combined with operation and maintenance and fuel supply, selling the customer *heat* according to an agreed tariff. Such an approach has a number of advantages:

- customers get what they want, which is energy without 'hassle';
- the provider brings a high degree of specialist expertise so that plant specification, installation, operation and fuel supply should be delivered efficiently and effectively;
- there are none of the contractual break points that *can* be problematic – for example between a plant supplier and a fuel supplier who cannot agree on the source of an operational problem;
- the provider will very often be able to procure capital items at discounted prices, thereby reducing the capital cost of installations;
- often the provider will provide a substastantial degree of finance, sometimes 100%, but sometimes with some form of connection charge, removing much of the financing burden from the customer and further helping to address the problem of high capital costs.

In some degree, this mirrors a wider trend in the liberalised UK energy market, in which energy services are becoming more and more common, with substantial companies such as Dalkia providing services to large numbers of both public and private sector organisations. In the context of woodfuel, it is also a trend that is emerging as a key mechanism for achieving greater market penetration in those countries that already have a substantial wood energy market.

The difference between an ESCO and a Heat Entrepreneur is not a rigid one but is generally a question of scale. A typical Heat Entrepreneur in somewhere such as Finland or Austria would be a farmer who perhaps provides heating to a small cluster of buildings (sometimes called a *micronet*) or even to a single premises such as a school, using woodfuel produced from his own forestry. An ESCO on the other hand would typically either operate a large-scale system such as a district heating plant and / or or a number of installations serving a mixture of end-users.

Both models have a potentially important role to play within the East of England, where one of the small handful of existing wood energy ESCO's in the UK is already based - Econergy Limited in Bedfordshire, covering the whole of the Region[69]. While still relatively young, Econergy has been successful in the Bio-energy Capital Grant Scheme under both 3a and 3b and therefore has a substantial degree of capital funding (c.£900k) that can be applied to boiler installations in the Region and beyond.

[69] See www.econergy.ltd.uk.

5. ACTION PLAN

Sections 4.2 and 4.3 both draw out the need for a number of actions in order to further develop woodfuel in the East of England. The point has already been made that these need to be both concerted and co-ordinated in order to be effective. To this end, this section draws together the points identified into a more widely cast Action Plan:

5.1. *Actors and stakeholders*

v. This strategy should be formally adopted across key organisations. These include the current funders and, with it's region-wide strategic overview, the Government Office (GOER).

vi. The strategy should be disseminated to other stakeholders – local authorities and other public sector, Community Forests, the CRI, Rural Community Councils and so-on, including also the private sector - making clear the commitment to implement it. The positive engagement of these stakeholders is essential to success.

vii. As indicated above, action must be both concerted and co-ordinated if it is to be successful, and it is almost certain this will require that a lead agency takes on the role of 'regional advocate'. Based on its immediate and particular concern with the woodland sector, it is suggested that this would most obviously be filled by the Forestry Commission, a role that is already beginning to emerge in regions such as the East and West Midlands and in the South East.

viii. Alongside the role of a regional advocate, serious consideration should also be given to resourcing a dedicated and autonomous networking, co-ordination and mentoring function comparable, for example, to the Advantage West Midlands funded *Marches Wood Energy Network* (MWEN) in the West Midlands.

5.2. *Principals*

vi. To be effective, it is important that all of the market barriers identified should be tackled in a concerted fashion - an *ad hoc* or poorly co-ordinated approach is simply unlikely to be effective.

vii. Build on the strengths that the Region undoubtedly has: an existing fuel supply infrastructure to supply FibroThetford and existing fuel supply contractors (MI Edwards and Econergy Ltd); a pioneering wood-energy ESCo, one of perhaps only three such companies in the UK and a tremendous source of local expertise (Econergy Ltd); a fledgling SRC *producer group* (Anglia EnCrops).

viii. Use existing demonstrations and develop further 'exemplars'. Already the wood boiler at the EcoTech Centre in Norfolk is used regularly in connection with promotional activities and it has an invaluable role in this regard. In contrast, the installation at Marston Vale is disastrous and should be rectified. While this will involve significant re-investment it could then provide a second, geographically distinct resource similar to EcoTech. Although there is a limit to the number of 'demonstrations' that are credible without a wider level of activity, further strategic 'exemplars' should also be identified and supported to give diversity of geographical coverage and also of applications. The proposal to include a wood boiler at the new Thames Chase visitor centre should certainly be supported.

ix. Build on experience and lessons learned elsewhere in the UK & Europe. It is arguable that the UK woodfuel industry has battled for more than a decade to achieve a model of development based around large, central electricity generation plant that is fundamentally difficult to achieve, and success has indeed been very limited at the time of writing. In contract, the use of woodfuel, primarily for heating, is an absolutely standard part of the energy mix across much of Europe, and countries such as Austria have shown how effective carefully worked through public sector support can be in stimulating both innovation and growth.

x. Focus on the easy, low risk things that can quickly make a difference to installed capacity and, thereby, to both awareness and confidence. By way of example, it would be relatively straightforward to 'seed' a number of 'self-supply' clusters with simple and achievable on-farm applications. In contrast, planning for large-scale community heating networks in new developments such as Elstow should certainly be pushed hard, but will take many years to come to fruition and must be kept in perspective. Similarly, waiting for a 'kick-start' from a power station at Eye, Corby or elsewhere has the potential simply to run into the sand and come to nothing.

5.3. Actions

Promotion and marketing

- Promote wood energy across the region to raise its profile via targeted PR and promotional events; facilitate networking.
- Focus marketing on the 'early adopters' - the public sector, the *Carbon Market*, *self-supply* farms, estates etc, the waste wood and wood processing industries - and on priority areas, particularly the RPA's.

Technical development and technical support

- Effectively signpost reliable sources of information and advice; support provision of such advice, for example by providing funding for the development of resource material (case studies, guidelines and so-on) and for feasibility / development studies.
- Target specifiers, for example via a CPD programme.
- Encourage diversification of a core of existing heating engineers / installers by providing focused training opportunities.
- Foster expertise within new ESCO's and HE's to ensure that they are able to provide an effective service.
- Work to improve fuel supply chain development – technical developments and information flows.

Initial deployment

- Use 'pioneer sites' to foster clusters of sites and local critical mass, for example in the RPA's and Community Forests; public sector managers should be strongly encouraged and assisted to consider woodfuelled heating as a viable option to create some such pioneers.
- Offer support to ESCO's and HE's, acknowledging the key role they are likely to play in achieving market penetration.
- Ensure that the national grant schemes are effectively promoted and consider providing additional capital support for both boiler plant and fuel supply infrastructure via regional grant aid targeted at pioneer sites and clusters.
- Use the demand created by live projects to drive supply chain development by creating 'market pull'; seek also to facilitate supply chain development from private sector woodlands into the FibroThetford power station; acknowledge the role of waste wood in pump-priming the industry in some circumstances and also the long-term role of energy crops by fostering the nascent regional producer group, Anglia EnCrops.

Most of the above can be put into effect relatively quickly, and if implemented effectively they will have a substantive impact in the short to medium term (by 2005). At the same time, they will provide the critical mass that is needed to see sustained growth into future, when pioneers and clusters focused on priority areas such as the RPA's can expand to create a diversified and more broadly-based woodfuel industry in the Region.