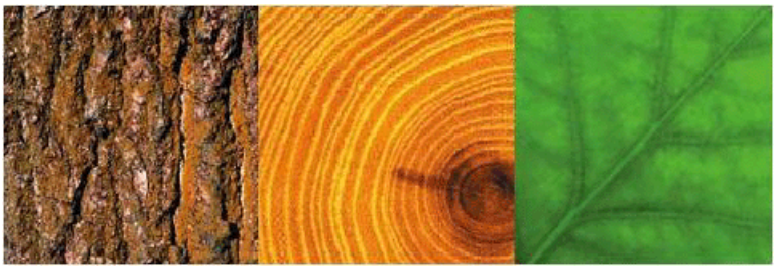
An economic evaluation of current and prospective value to the north east of England from biomass-related activities



northwoods

The North East's Woodland Initiative

A study for the Forestry Commission, north east region,
and for the NEWHeat programme of One NorthEast

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Executive Summary

The biomass sector is a small but growing component of a robust forestry and renewable energy sector in the north east of England. This report suggests that the sector currently provides an annual contribution of at least £40m to the north east economy, and that it has the potential to generate at least £76m per year by 2015 – a 90% increase. Analysis undertaken for this report also suggests that biomass, rather than coal, will ultimately be the more important solid fuel in economic terms.

The bulk of this economic benefit currently comes from the activities of the three major biomass plants in the region. However, the growth of the economic activity between now and 2015 will come predominantly from the growth in the small-to-medium scale (<2MW) biomass sector. This analysis therefore justifies One NorthEast's current investment in the sector – which is directed at installations of that scale – and would suggest that similar mechanisms in the future would provoke the strongest economic drivers for the sector.

Whilst it is not the place of this document to argue for increased investment in the sector, there seems to be little doubt that there are large economic multipliers working hand in hand with biomass installations, some of which may be initially hidden to the layperson.

The role of biomass in displacing carbon emissions from combustion of fossil fuels is increasingly being recognised by central, regional and local government, by private business and environmental pressure groups, and perhaps most importantly, by a growing proportion of the general public. This has led to the implementation of various schemes to increase the amount of installed capacity in various parts of the UK (market push). This includes the NEWHeat programme in the north east.

At the same time, many entities – corporate and public – are realising that biomass offers a cost-effective method of heating (and in some cases, providing electricity) for their sites, with the additional benefit of demonstrating a commitment to the environment (market pull).

The role of the European Union in driving the cause of renewable energy, sometimes against the entrenched interests of public or private organisations in different member states, means that support for renewables is likely to be maintained or strengthened in the future. As biomass is currently the clear leader in the renewable energy market in terms of displacing current fossil fuel heat load, it is likely to benefit strongly from evolution of policy in this area.

It is worth noting that this report considers the market value of biomass (principally woody biomass, which forms the bulk of current activity), and not the value of displacement; a school which is heated on biomass will be displacing the cost of fossil fuel (which could be up to double the cost) and is maintaining that value in the local economy, rather than exporting value overseas.

There are also significant gaps in knowledge about how much biomass from the region is supplied to the three largest users – Egger, Alcan and Sembcorp – and this means that the value ascribed to the biomass material itself is perhaps an order of magnitude less than the true figure.

It is for these reasons that the figures in this report should be viewed as a conservative estimate; the true value to the region is almost certainly far higher. A summary of quantified exclusions is included in the appendices.

Finally, we have not attempted to quantify the employment benefits which arise as a result of a thriving biomass sector, but existing studies indicate that in the region of 2,000 full time jobs could be created in the region by 2015 if a strong level of support is maintained.

Note: This bulk of this report was written prior to the proposal to build a 350MW_e biomass plant at Teeside was announced, and it has therefore not been included in the body of the report. Including this in the 2015 figures would increase the annual value to £101m, and could increase the number of permanent regional jobs in the sector by 150.

1. Introduction

Northwoods is the woodland initiative for the north east of England. Northwoods has an excellent track record of support to the forestry sector, which takes a variety of forms, including delivering training to enable new entrants or to support existing ones. We also manage several projects designed to support biomass, including running the north east woodfuel producer group (NEWFuels), the biomass demand side support programme in the region (NEWHeat), the RDPE woodfuel grant support mechanism (bioeNErgy), and the UK woodfuel expo (Ignition09) which is due to take place at The Sage, Gateshead in March 2009.

Northwoods was commissioned to undertake a study of the value to the north east economy from biomass-related activities, and to attempt to quantify predicted levels of activity and value at a future date, set as 2015. This research is partly a contribution to the marketing activities of the NEWHeat project, which aims to persuade policy makers and the business community of the benefits of biomass to individual businesses and to the region as a whole, and partly to support the activities of the Forestry Commission in the north east.

There is massive potential for biomass to add value across a wide variety of processes and sectors[1], including forestry, processing, transformation, conversion and application, and small amounts of funds dedicated to kick-starting this process have not only the potential to lever in large amounts of funding from other sources, but have been demonstrated to do so.

The biomass sector has the potential to greatly benefit rural businesses (which play the predominant role in the wood fuel supply chain) and to enhance the management of currently under-managed woodlands, as well as being a major contributor towards the reduction of energy-related carbon emissions across the UK.

Whilst these arguments are being made by people within the industry, there seems to be reluctance in certain circles to accept fully that the biomass sector is a very powerful driver for economic development – particularly in sectors which have traditionally lacked access to traditional support mechanisms (such as the rural business sector).

It is particularly interesting in the context of the economy of the north east to note[1] that the amount of coal produced in the region is diminishing year by year, as the use of biomass ramps up; it is likely that over the coming years, biomass use in the region will exceed coal production on a tonnage basis.

This report aims to highlight that current activity contributes a significant amount to regional economic activity, and to demonstrate the potential levels of economic activity which could be achieved – given the necessary support – by 2015.

The focus of the report is very much on woody biomass rather than annual crops, such as cereals. This is because the carbon balance of woody biomass is better than ‘dedicated’ crops, which frequently require intensive farming practices. There are also strong cost benefits in woody biomass (which provides energy principally from ‘waste’ or low-value streams); and dedicated energy crops are currently a very marginal part of the overall picture.

[1] See Section 7

2. Political and policy considerations

The UK currently has a number of policies designed to increase the amount of renewable energy installed in various sectors. Some of these are 'generic' support devices, some directly target biomass.

This document does not set out to provide an exhaustive list of measures which are currently being implemented or proposed, but there are some key elements to draw out of the direction of travel of energy policy in the EU and the UK.

Table 1: Some key policy drivers (proposed or implemented)

Policy	Period covered	Region	Target
Kyoto protocol	2005-2012	World[2]	CO_2 emissions 12.5% below 1990 figures (UK)
EC spring council (2007)	To 2020	EU	15% of primary energy to be provided from renewables by 2020[3] (UK)
EU Emission trading scheme	2008-2012 (2nd phase)	EU	Cap and trade scheme providing a price for CO_2 emissions for large emitters (generally greater than 20MW_{th} output)
Climate change bill[4]	2008-2060	UK	60% cut in CO_2 emissions by 2060 (compared with 1990 levels)
UK renewable energy strategy	To 2010, 2020	UK	10% of electricity to come from renewables by 2010, 20% by 2020
Carbon reduction commitment	From 2010	UK	Cap and trade system for CO_2 for large (>6,000MWh/yr electricity) energy users
'Merton-rule' type policies	Current and ongoing	UK	Requirement to provide a certain percentage (currently 10-20%) of energy in large developments from renewables
Code for sustainable homes	2008-2016	UK	New homes will have to be carbon neutral by 2016 (level 6), sliding scale of carbon performance until then
UK renewable energy strategy (consultation stage)	2010 to 2020	UK	15% of UK energy to come from renewables; financial incentive for renewable heat; discouraging the landfilling of biomass; new non-domestic buildings to be zero-carbon by 2019
Carbon Emissions Reductions Target	2008-2011	UK	Biomass eligible for target if used in district heating schemes

All the indications are that policy will increasingly restrict the ability of private and public institutions, and potentially private citizens, to emit carbon dioxide without paying some kind of financial penalty (or, conversely, those who emit less might be rewarded). Planning permission for new buildings is unlikely to be possible unless a portion of the predicted energy use onsite is derived from local renewable energy sources.

This puts all renewable energy generating systems in a strong position – particularly as the price of fossil fuels is at a historic high (even allowing for inflation), and looks set to maintain prices at least until 2010 (see Figure 1).

Thus the market for biomass is driven by market and policy. It is likely that the final market for biomass heating (and electricity) will be limited predominantly by the availability of a sustainable source of raw material. This point is probably between ten and twenty years off[5].

[2] Unratified by the USA and Kazakhstan
[3] http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/80
[4] Draft bill as of 25th June 2008
[5] This assertion is supported by research undertaken by Northwoods, the FC and others. Please contact the author for further details

3. Methodology

There is, as far as we are aware, no published data on the contribution of the biomass industry to the economy of the region. We are also unaware of any other region which has produced any research on the topic, and consider it unlikely that this has been carried out at a UK level. This research takes data from a number of areas:

- Existing reports on forestry activities (which sometimes detail levels of activity of biomass)
- Official data on renewable energy in the UK (as supplied by OFGEM and DBERR), and on the ETS scheme
- A questionnaire to installers active in the region
- Existing studies on biomass and forestry in different European countries (in order to draw some conclusions about possible activity in the UK by 2015)

Where there is a lack of region-specific data, we have used a simple metric, which takes the proportion of the figures of the UK as the ratio of the population of the north east to that of the UK as a whole. This is almost certainly a conservative estimate, as the north east has a disproportionately large forestry sector which would support a bigger biomass sector than in most other regions. The population of the north east is 2.5 million[6], and that of the UK is 60.6 million[7], so the north east represents 4.15% of the UK population, and we use this proportion of any UK figures to justify the value to the north east economy of any UK figures.

We feel that it is important to use conservative estimates where there is significant uncertainty in the data, as this makes the final figures more likely to be an underestimate of the true value, and therefore more defensible. We have, however, made a list of the additional value which could reasonably be added to the headline figures – this list is available in the appendices (Section 7).

The value to the region can be determined principally by quantifying current activity in four main sectors:

1. Biomass plant installation/maintenance activity
2. Wood fuel extraction, storage, processing and delivery
3. The value retained within the region from generation of electricity from biomass
4. The related value within the region from the Renewable Obligation Certificate (ROC)

There are additional sectors which contribute to the total:

5. Reduced external costs due to displacement of using gas and oil for electricity generation
6. Education/training
7. Additional sectoral activity (feasibility work, specialist additional work e.g. electrical connection feasibility, listed building analysis etc)
8. Carbon value – this is the value in carbon to the region which is almost certainly being claimed (by Egger, Alcan and Sembcorp as they are larger than the 20MW_{th} European Trading Scheme threshold)

The tables below summarise the findings of the regional value from biomass activity at current levels, and potential value at 2015.

Table 2: Summary of economic value to the region from biomass activity

Activity	Estimated annual value to the region, 2007/08 (£M)	Estimated annual value to the region, 20014/15 (£M)
1. Biomass plant installation/maintenance	4.00	20.00
2. Woodfuel value	2.02	4.40
3. Electricity value	17.88	25.59
4. ROC value	7.67	16.56
5. Carbon value	1.25	1.40
6. Reduced external costs from electricity generation	7.02	7.85
7. Education/training	0.04	0.14
8. Additional sectoral activity	0.10	0.35
Total	**39.98**	**76.29**

[6] www.statistics.gov.uk/census2001/pyramids/pages/a.asp
[7] www.statistics.gov.uk/cci/nugget.asp?ID=6

4. Current value

Biomass plant installation/maintenance

The main companies currently involved in installation work in the north east are[8]:

1. Econergy
2. Wood energy ltd
3. D&E turf
4. Toasty heating
5. Ian Chappell
6. 3G energi
7. Dunster woodfuels
8. Mercia energy ltd
9. Rural energy ltd
10. Manco energy

A questionnaire was sent out to all the named companies, asking them to detail their current levels of activity, and asking them to predict the levels of growth of their business to 2015 if possible. A follow-up phone call was also made to try to elicit information. The responses[9] detailed the following:

Table 3: Summary of responses to installer questionnaire

Installations in NE (2007)	Capacity installed (MW, 2007)	Value to company (£M)	Activity increase in 2008 (%)	Activity increase by 2015 (%)	More or less busy by 2015
16	4.1	2.0	100	500	More (all installers)

Note that this category does not include any installation/maintenance in the sector from plumbers who are contracted to work on biomass installations (externally to any turnkey contracts with installers). This figure is assumed to be low given current levels of market penetration, but could become highly significant with higher levels of sectoral activity.

As only a small number of responses were received we have multiplied the value by two, to reflect the probable value which was not directly reported to us, for a total regional value of £4.0m.

Woodfuel value

The value of woodfuel to the supplier (or cost to user) varies (in cost of raw material/tonne or p/kWh) with the quality of the fuel and of the amounts being used at each site. Making an assessment of the value of woodfuel is difficult for two reasons:

1. Not all of the source material is derived from the north east (which means that some of the value which is paid for is retained in other regions of the UK, probably the north west of England to a large extent which has a well-developed wood recycling industry)
2. The commercial cost of locally produced coal is probably comparable with recycled wood, so the nominal value in the displacement of locally-produced coal is relatively small (although the carbon cost is not)

Thus we cannot simply state the amount of wood being consumed in the region and assign a value to it without determining its origin; nor can we assign a value to the displacement costs, as this is likely to be low.

There will be a large number of biomass users in the region who are unknown to us. Many of these will be small (generally domestic) users, some may be larger installations. The error in not having data from all users is diminished by the fact that the major users, which account for the vast majority of biomass use, are known – these are listed in Table 4, along with the quantity of fuel used annually.

[8] This list was chosen from installers on the clear skies list who are active in the region, but may exclude some installers who have not come to our attention

[9] Only 4 responses were received, so the value from this component is a significant underestimate of the real figure (see appendices)

Table 4: Biomass users in the north east

Plant name	Boiler size (MW)	Installation type	Fuel type	Fuel quantity (tonnes/yr)	CO_2 offset per year, tonnes[10]	Value of biomass (£m/yr)[11]
Egger (Hexham)[13]	50	Heat	Fines	50,000	28,500	1.00
Alcan[12,13]	38	Electricity	Imported wood pellet, olive residue	90,000	51,300	1.80
Sembcorp[13,14]	30	Electricity	Chip	300,000 green tonnes/yr[15]	142,500	6.00
			Chip (SRC)	15,000 ODT/yr[16]	1,967	0.60
Clothier labs	0.5	Heat	Chip	300 (35% MC)	171	0.01
Hexham swimming pool	0.5	Heat	Chip	750 (35% MC)	428	0.03
Sainsbury's, Alnwick	0.45	Heat	Pellet	200 (35% MC equivalent)	114	0.01
Newcastle schools	1.5	Heat	Chip	1300 (35% MC)	741	0.06
Other installations[13]	3.0	Heat	Various	2600 (35% MC)	1,482	0.12
Total	**124**			**444,000**	**225,235**	**9.03**

The author has not found any published figures for wood obtained from regional sources which is combusted at the plants of Egger, Alcan and Sembcorp, but estimates from the Forestry Commission and Renewable Energy from Agriculture[17] suggest that a reasonable portion of the virgin product used at Sembcorp (50kt) and 10kt (minimum) of wood is supplied to Egger annually from the north east.

On this basis, and knowing that the smaller installations obtain their fuel from regional sources, we therefore conclude that at least 4,000 tonnes of wood is being harvested from the north east for use in small biomass boilers in the region (value of £220,000), and 60,000 tonnes to large boilers (value of £1,200,000), for a total of £1,420,000 to the region[11].

Sembcorp also takes 15,000ODT (Oven Dried Tonnes) equivalent of SRC from the region, for an annual value of £600,000 at £40/tonne.

The combined total of SRC plus 'traditional' biomass is therefore £2,020,000.

Electricity and ROC value

The regional analysis is simplified by the fact that there are two very large electricity generators in the north east which use biomass. Only one of these, Sembcorp, generates electricity exclusively from biomass (the Alcan facility generates electricity from cofiring, but the proportion of electricity generated from this source is unknown). We therefore assume that the 30MW Sembcorp plant has a load factor of 85%[18], generating some 223,530MWh annually, which corresponds to a ROC value of £7.67m[19].

The value of the electricity itself is the wholesale market price. This figure is notoriously variable, though it has increased markedly in the last two years. The current market figure is 9.5p/kWh[20], and average price to 2010 in the futures market is approximately 8.0p/kWh. Using the figure of 8.0p/kWh gives a value of electricity from Sembcorp's biomass combustion of £17.88m.

[10] Compared to mains gas, and assuming 35% MC wood (except where stated 'green') at 2,750kWh/tonne, and mains gas at 0.19kgCO_2/kWh
[11] A 'floor' figure of £55/tonne has been used for small installations, £20/tonne for large
[12] www.energynortheast.net/page/map/popup.cfm?displaymode=2&projectId=66&areaId=0
[13] www.wrap.org.uk/document.rm?id=4981
[14] www.wastexchange.co.uk/detailNews.phpsc?doc=/GARWER/DOCS/news/4E4-0C8-CFC
[15] www.unece.org/trade/timber/mis/market/market-65/uk.pdf
[16] Approx 50% provided from within north east
[17] Private correspondence with Forestry Commission, north east region, and with REfA
[18] Private correspondence with Steve Bishop of Sembcorp Utilities
[19] ROC value of £34.3/MWh in 2007/08
[20] http://www.heren.com/view_sample_report.php?MenuId=2.1.2&ReportId=2; accessed 20th June 2008

UK OTC power price assessments 10 June 2008				
Period (£/MWh)	Baseload			% Change
	Bid	Offer	Diff	
Day-ahead	96.00	97.00	2.000	2.12
Week 25 '08	85.00	85.35	-1.000	-1.16
July '08	79.80	80.00	0.300	0.38
August '08	76.75	77.25	0.575	0.75
September '08	79.40	79.90	0.150	0.19
Q3 '08	78.35*	79.35*	0.350	0.45
Winter 08	87.55	88.25	-0.300	-0.34
Summer 09	77.30	77.80	-0.350	-0.45
Winter 09	84.25	84.85	-0.475	-0.56
Summer 10	73.50	74.50	-0.500	-0.67
Winter 10	80.75	81.10	-0.775	-0.95

Figure 1: Current and futures market (wholesale prices)

Carbon value

All large fuel users in the UK (i.e. those above 20MW_{th}[21]) have to take part in the European Trading Scheme (ETS) for Carbon, which requires them to register their carbon emissions, and to pay to offset them if they exceed their allowances. The scheme allows for trading of carbon between participants.

The following table indicates the large thermal plants in the north east which are either registered with the ETS[22] or could claim CO_2 credits due to their size; and the value of the CO_2 which could be, or is being, claimed.

Table 5: Value of carbon to selected companies through the ETS (estimated)

Company	Amount CO_2[22] (Mt)	CO_2 offset from biomass (t)	Carbon offset[23] (t)	Value of carbon offset, £[24]
Alcan Aluminium UK Ltd	2.725	51,300	13,990	289,033
Sembcorp Utilities (UK) Ltd	1.501	142,500	38,863	802,864
Egger	n/a	28,500	7,773	160,590
Total		**222,300**	**60,626**	**1,252,487**

Note that the carbon value is explicitly stated as that which can be claimed on the open market. The value of £42.3/tonne of CO_2 stated in the Stern report[25] would increase the carbon value (to the environment in a global sense) to £11.95m.

Reduced external costs

Research undertaken at the European level has attempted to quantify the external costs of power generation from conventional fuels[26]. The external costs include:

- Mortality of human health (from pollutants such as PM_{10}, SO_2, NOx, O_3, Benzene)
- Morbidity of human health (similar pollutants)
- Damage to building materials (SO_2, acid deposition, combustion particles
- Crop damage (pollutants)
- Climate change (greenhouse gases)

[21] www.ehsni.gov.uk/eu-ets-guidance01.pdf
[22] www.defra.gov.uk/environment/climatechange/trading/eu/phase2/pdf/nap-annex-1-list-installation-level-allocations.xls
[23] Carbon to carbon dioxide conversion is at a ratio of 12: 44
[24] www.pointcarbon.com/, accessed 02/06/08 showing €26.15/tonne, and using exchange rate of 0.79£/€, for a value of £20.66/tonne
[25] www.hm-treasury.gov.uk/media/4/3/Executive_Summary.pdf, $85/tonne of CO_2 stated
[26] http://europa.eu.int/comm/research/energy/pdf/externe_en.pdf

- Amenity losses (noise)
- Ecosystem damage (pollutants)

The value/cost of carbon due to biomass combustion is covered explicitly later, and it seems reasonable to use the quoted values and to subtract our carbon value from this total to obtain the external costs displaced due to biomass combustion.

The costs are stated as:

Cost (p/kWh)[27]			
Coal/lignite	Oil	Gas	Biomass
3.1-5.5 (av. 4.3)	2.3-4.0 (av. 3.2)	0.8-1.6 (av. 1.4)	0.8

With a plentiful supply of biomass, the north east is well placed to displace costs of approximately 3.5p/kWh from combusting biomass in place of coal. Of course, some of these external costs are passed to neighbouring regions, countries and ecosystems, so much of this value is lost to the region; although it is recouped elsewhere.

As the only known quantity of electricity in the region generated from biomass is at Sembcorp, we use the estimated plant output of 223,530MWh. This provides displaced costs of £35/MWh generated, for £7.82m. The carbon value generated at the plant is estimated at £0.80m, which leaves a net benefit from combustion of biomass instead of coal of £7.02m.

The value from smaller users displacing the combustion of gas, oil or coal for heat purposes has not been quantified, although there will be additional value from these boilers.

Education/training

There is a considerable potential value to the region due to education and training. This is currently being driven by Northumberland College, which is finalising its programme of biomass training at its Kirkley Hall site. The biomass training will occupy approximately one FTE member of staff, and will train up to 30 students per year to NVQ levels 2 and 3.

We have no access to data demonstrating the financial value of training provided to students, and therefore have to base the value to the region solely on the value of employment for one staff member, which we put at £30,000.

There is potential interest in supplying specific biomass-related activities at the proposed Newcastle University CREEL centre at Cockle Park, and also at Houghall College; the economic outcomes of this are currently unquantifiable.

Northwoods also undertakes training in biomass, on the fuel supply side, and this helps support two jobs, for an estimated value to the region of £5,000 per annum.

Additional work in the sector (e.g. training in forestry techniques which go on to be used in the biomass sector) is also unquantifiable.

It should be noted that the North East Sector Skills Agreement highlights the Tree and Timber sector as being important economically, environmentally and due to the concentration of related businesses in this region. Biomass activities also have the potential to counter the projected continuing fall in agricultural employment to a certain extent. Tree and Timber employers highlighted the need for focus on the ‘use of new technologies’ for the projected skills need of the sector, a focus which could link particularly well with a buoyant biomass sector.

Additional sectoral activity

Northwoods has a good grasp of levels of activity in the sector outside the installer base and the fuel supply chain, as we deal on a daily basis with external consultants who carry out feasibility studies into biomass systems in the north east.

We estimate that there are at least 5 FTE biomass specialists carrying out work on biomass feasibility, and on other detailed biomass work which is not covered directly in the other sections, in the region. These

[27] Exchange rate of 0.79£/€ used

include staff at companies such as CP Energy, RES, North Energy, Northwoods, and Renewable Energy from Agriculture. There will also be additional feasibility work carried out by installation companies which is not directly associated with installation work. The day rate for such consultants is generally of the order £4-500/day, and the annual value to the region of these specialist skills would therefore be approximately £99,000.

5. Potential value to the region

The target for UK primary energy generation from renewable sources by 2020 set at 15%[28], up from 1.5% in 2006. This is a ten-fold increase in capacity and activity across the board. The increase between 2008 and 2015 is significantly less than this, though still a large factor of growth.

Heat makes up 49% of UK energy demand; renewable heating will make up 14% of this by 2020 (Figure 3).

Calculating rate of increase of activity 2008-2015

2006 baseline (UK)

In order to determine the activity at 2015, we will use UK-wide figures of predicted capacity. We therefore have to calculate the current activity levels UK-wide. The most recently published data come from 2006.

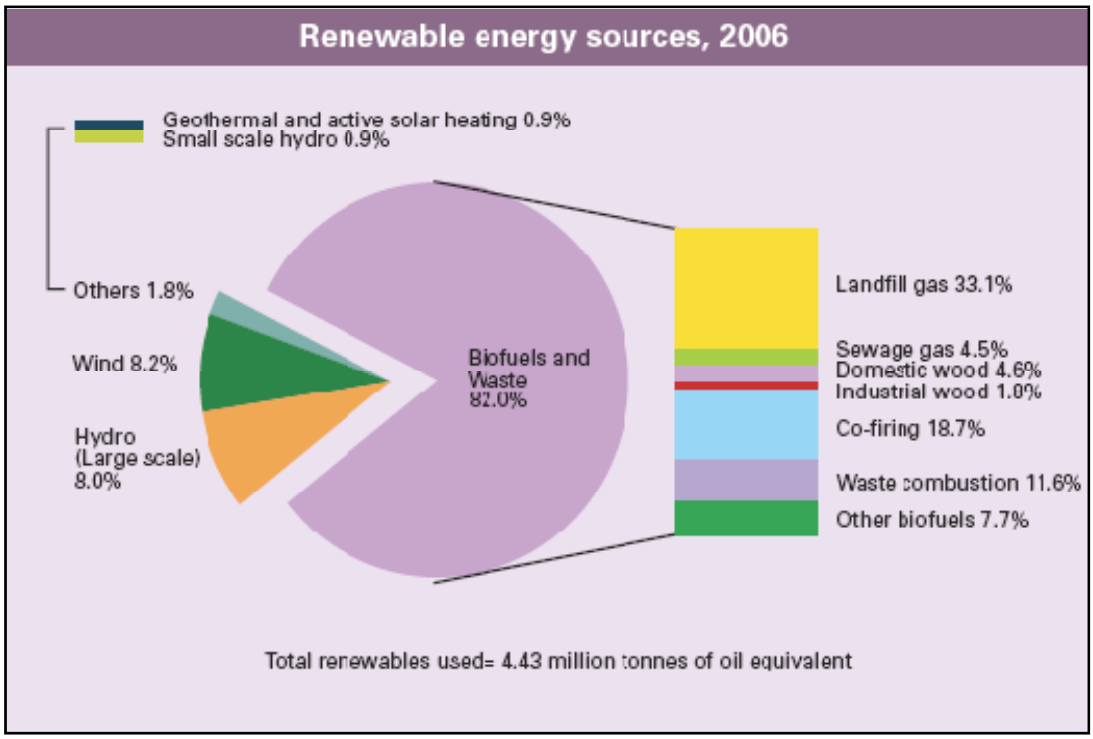

Figure 2: Renewable energy supply to the UK, 2006 (DBERR)

Of the 4.43Mtoe[29] supplied by renewable energy, 4.6% was supplied to domestic wood users, 1.8% to industrial wood users, and 18.7% generated in co-firing (the vast majority from woody biomass). We can therefore calculate the generation figures and Mtoe equivalents as follows:

Table 6: Biomass contribution to energy supply, 2006

Renewable source	Energy sector	Proportion of renewable supply generated (%)	Mtoe	Proportion of total energy supply (%)
Biomass	Heat	5.2	0.23	0.10
Biomass co-firing	Electricity	15.3	0.68	0.43

[28] UK renewable energy strategy consultation, BERR, June 2008
[29] Million tonnes oil equivalent

2020 prediction (UK)

The illustrative technology breakdown to reach 2020 targets of 15% total energy from renewables is outlined in Figure 3.

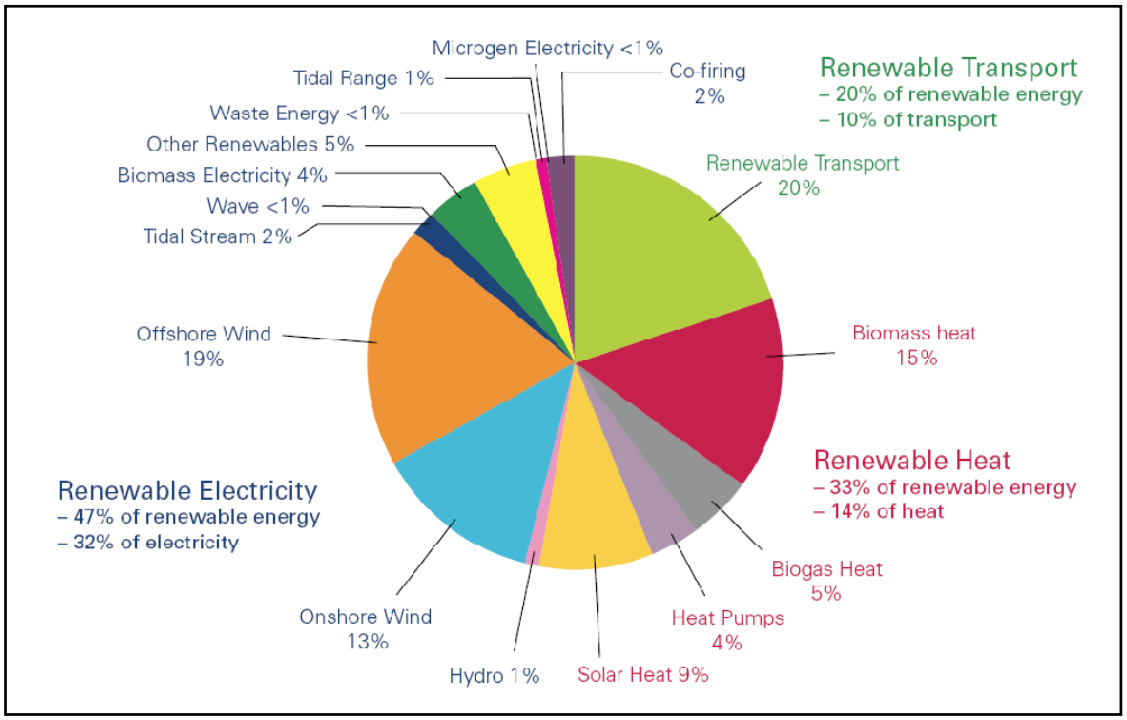

Figure 3: Illustrative breakdown of renewables by 2020 (source: DBERR)

This enables us to calculate the proposed energy output from biomass by 2020 (Table 8), and to compare it with current output. Note that we use the figures of 49% of total energy supplied as heat[28], with the remainder assumed split evenly between electricity and transport (25.5% each).

Table 7: Energy figures for the UK (DBERR)[30]

In TWh	Renewable energy in final energy consumption, 2006	Renewable energy in final energy consumption, 2020	All energy final energy consumption, 2006	All energy final energy consumption, 2020
Heat (excluding electricity for heat)	4	90	735	635
Electricity	19	120	393	375
Transport	2	55	653	730
All sectors	25	265	1781	1740

The latest DBERR assessment (see Table 7) suggests a marginal reduction in total energy use by 2020, from 157.8Mtoe in 2006 to 149.6Mtoe. This assumption is shared by the Renewables Advisory Board[31].

[30] Conversion of TWh to Mtoe is 11.63:1
[31] www.berr.gov.uk/files/file46652.pdf

Table 8: Energy output from biomass[32]

Energy source	Energy type	Share of renewable heat market (%)		Share of renewable electricity market (%)		Share of total energy market (%)		Mtoe	
		2006	2020	2006	2020	2006	2020	2006	2020
Dedicated heat	Heat	88.0	45.5	n/a	n/a	0.1	3.1	0.3	4.7
Dedicated electricity	Electricity	n/a	n/a	0.0	8.5	0.0	0.7	0	1.0
Co-firing	Electricity	n/a	n/a	18.7	4.3	0.4	0.4	0.7	0.5
Totals		**88.0**	**45.5**	**18.7**	**12.8**	**0.5**	**4.2**	**1.11**	**6.2**

Renewable electricity will supply 32% of total electricity, and renewable heat will make up 14% of total heat by 2020. This means that dedicated biomass heating will supply 45.5% of renewable heat, 6.4% of total heat, and 3.1% of total energy by 2020. Biomass will also supply 12.8% of renewable electricity, 4.1% of total electricity and 1.1% of total energy by 2020. Total contribution to the energy supply in heat and electricity sectors is therefore 4.2% by 2020.

Several interesting points immediately fall out of this analysis:

- BERR figures suggest that the amount of electricity generated from cofiring will reduce from 2006 to 2020
- Heat from biomass (generally the most effective use of the raw material) will take three times more of the market than electricity by 2020 (which is the reverse of the current situation)

We do not believe that the co-firing activity in the north east will reduce from its current levels to 2015, and for this reason, have based our increased activity figures on a static co-firing activity level.

2008-2015 activity increase (UK and north east)

We assume that there is a linear increase in activity between 2006 and 2020, and extrapolate figures for Mtoe activity at each point, and for each biomass sector. This provides an indication of the factor by which the sector has to increase to meet the 2020 target.

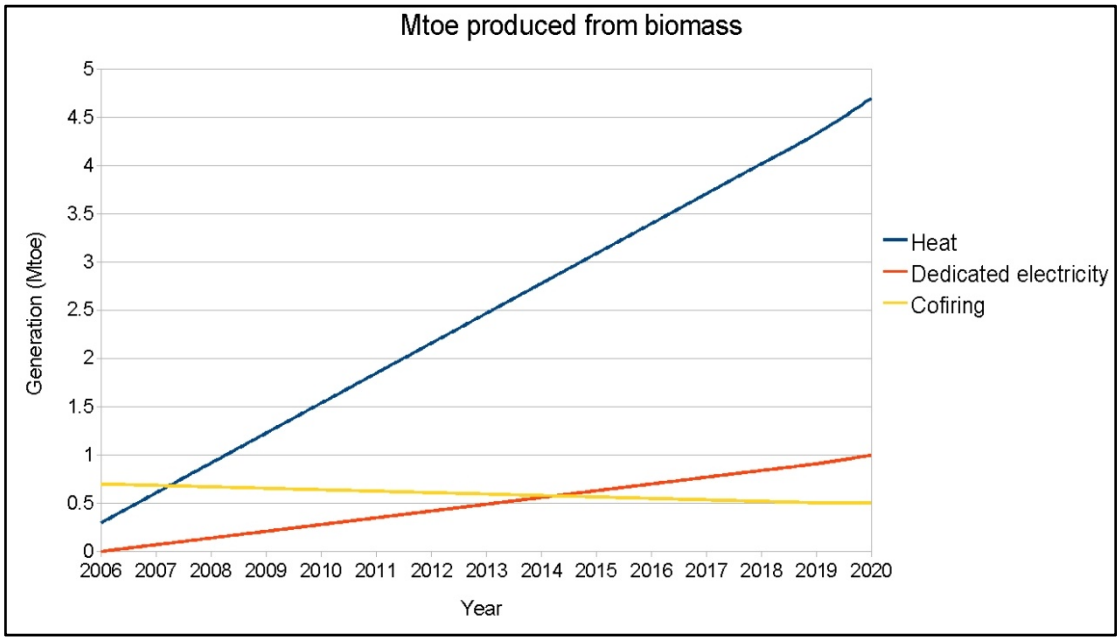

Figure 4: Predicted increase in UK biomass activity, 2006 to 2020

[32] Table summation errors are caused by rounding

So the increase in biomass activity can be calculated using figures extracted from the above graph:

Table 9: Predicted increase in activity per biomass sector, 2008 to 2015

Type of generation	Generation 2008 (Mtoe)	Generation 2015 (Mtoe)	Factor of increase
Heat	0.92	3.09	3.35
Electricity	0.14	0.63	4.50
Co-firing	0.67	0.57	0.85
Total	1.73	4.29	2.50

The increasing activity in each sector is relevant to the situation in the north east, as is the overall factor of activity. We use the combined factor of growth for heat and electricity generation, and exclude the co-firing figures which we do not believe will reduce in the north east – this gives the 'total growth factor' in the north east as 3.5 for the heat and dedicated electricity sectors. However, our own enquiries to the biomass installers network suggests a prediction of a five-fold increase in installed capacity; we use this figure in preference for small-scale heating, as it is a more primary source of information.

This factor will need to be tempered by the available resource if considering value for wood fuel – for example, there would not be the resource to support a 3.5-fold increase in output from heat for large boilers in the north east.

For this reason, we assume that the 'real' rate of growth of large-scale electricity generation – either through dedicated electricity plants or co-firing – will be nil to 2015.

Biomass plant installation/maintenance

Our figures for current activity in the region for plant installation and maintenance suggest that a minimum of £4m of activity is taking place.

Our enquiries to the installer network received predictions of activity up by 500% to 2015. Excluding the co-firing sector (which will nonetheless require maintenance), we assume that there will be five times the activity in the sector by 2015, for a total of £20m.

Woodfuel value

The woodfuel value in the sector will remain constant (co-firing) and increase by a factor of 5 (small-scale heat. Given that there are no published plans for development of further large-scale biomass boilers in the region (10's of MW), we also assume that there will be no growth in large-scale heat or electricity generation.

We assume that there is no net gain in value of woodfuel to 2015 (i.e. any gain in value to the region through increased value of the fuel is offset through increased costs to the producers).

We do, however, allow for an increase factor of use of SRC (or other energy-crop related fuel) value, as increased ROC value and continued support for planting should mean a steady increase in planted area to 2015. This factor is suggested as 3.5, in line with 'national' figures of growth of the heat sector.

Sector	2008 figures		Growth rate (multiple)	2015 figures (MW)	
	MW	**£m**		**MW**	**£m**
Small-scale heating (<2MW)	6	0.22	5	30	1.10
Large-scale heating (>2MW)	50	0.20	1	50	0.20
Co-firing	38	Unknown	1	38	Unknown
Large-scale electricity (standard fuel)	30	1.0	1	30	1.00
Large-scale electricity (SRC)	Included in 30MW figure	0.6	3.5	Included in 30MW figure	2.10
Total	**124**	**2.02**		**139**	**4.40**

Electricity and ROC value

Our assumption that there will be no large-scale increase in electricity value produced in the region stands, particularly bearing in mind that there are no published plans for construction of further dedicated biomass

electricity plants, which would have long lead times, in the region[33]. We therefore conclude that electricity and ROC generation levels will remain constant, except for a small increase in the capacity factor of the Sembcorp plant from 85% to 95% after its first year[34] (which will therefore yield 249,828MWh by 2015 rather than the current 223,530MWh). There will, however, be some value inflation. Some of this is derived from ROC levels (as determined by OFGEM). Some will be derived from increasing electricity wholesale prices.

We assume that electricity prices remain constant to 2010 (as inferred from the futures market, Figure 1), and then increase by 5% annually. This means that the electricity value by 2014/15 will be 28% higher than the value today.

ROC values in 2014/15 are predicted to be £40.77/MWh[35]. There will also be an elevated ROC value for biomass electricity (1.5 ROCs per unit), and double ROCs for energy crop biomass electricity.

Assuming that SRC makes up 3.5 times its current input to Sembcorp (for a total of 52.5kt), the double-ROC value will be applied to 30% of the total. This provides the following values (including the 11.8% increase in output):

Generator	2008 values (£m)		2015 values (£m)		
	ROC	Electricity	ROC (1.5 multiple)	ROC (double value)	Electricity
Sembcorp	7.67	17.88	11.46	5.10	25.59

Carbon value

We assume that the value of carbon remains static to 2015, and that the only significant additional carbon offset value comes from the increasing output from the Sembcorp plant.

An increasing number of businesses will start to trade in carbon as the Carbon Reduction Commitment (CRC) affects smaller businesses. The value of carbon will be capped in the first three years to £12/tonne CO_2[36].

The only business in the region which has a biomass boiler installed and is currently sizeable enough to take part in this scheme is the Sainsbury's store in Alnwick, which will offset 114 tonnes CO_2/year, for a value of £1,368. If the number of this sort of development in eligible businesses were to increase by the predicted factor of 3.5, there would be an additional £4,788 kept in the region. This amount is marginal, and could end up making its way to the head office of these chains, and is therefore not included in the total.

Reduced external costs

The reduction of external costs in 2015 would be proportional to the increase in installed biomass (assuming that it resulted in an offset of fossil fuel).

The costs stated in the Externe report[26] are directly related to electricity production; our analysis suggests that large-scale electricity generation in the north east will increase by 11.8% by 2015, and we therefore increase the value to reflect this.

Education/training

In order that the installation and maintenance activity in the region is made possible, an equivalent increase is required in education and training activities. This would increase the value to the region of this activity to £0.14m.

Additional sectoral activity

As with the education and training sector, we anticipate that the additional sectoral activity will multiply by a factor 3.5, to give a value by 2015 of £0.35m.

[33] This statement was made prior to the announcement of the proposal to build a 350MW_e plant at Teeside
[34] Private correspondence with Steve Bishop of Sembcorp Utilities
[35] www.fimltd.co.uk/downloads/The%20Investment%20Opportunity.pdf
[36] www.defra.gov.uk/environment/climatechange/uk/business/crc/qanda.htm

6. Validation of predicted value by comparison

It is useful to validate the methodology by comparing the values generated from our analysis with existing reports on potential of biomass, and with the state of the market in different European countries.

Table 10: Summary of potential value to the region by 2015

Method of predicted value	Capacity of installed biomass in the north east by 2015	Value to north east, (£m)[37]
Existing UK studies (electricity)	1,107.5GWh (electricity), equivalent to approximately 184MW installed generating capacity operating at 70% capacity	107.5
Comparison with Upper Austria (heat)*	350MW (assume mostly heat and 25% capacity factor)	19.18
Comparison with Denmark (heat)*	11,503GWh (assume the energy is supplied as heat)	28.76
Carbon value		2.01
Total		**128.69**

*The lower of these two values is selected for the purposes of determining the value

It is clear that our methodology underestimates the value to the region as determined through the existing studies. If, however, the £16.3m of 'exclusions' (as noted in Section 7) are added to the conservative figure of £71.5m for a total of £87.8, and we note that the studies look at 2020 and our study focuses on 2015, the variance is not great. We also believe that our data are more robust than generic UK studies, as they draw on evidence which is probably not considered at a UK level.

Nonetheless, it is clear that almost every meaningful comparison indicates that the potential of the sector in the region is great, and that the figures obtained from our analysis indicate a lower threshold – with ambition, strategic vision and effective deployment of resources, the value of the sector by 2015 would be more like the comparative figures obtained in this section than the headline figure of £71.5m.

Comparison with existing studies

Three studies have attempted to quantify the UK-wide benefit of a mature biomass industry by 2020. The main points are summarised in Table 11.

Table 11 : Existing studies of UK potential for biomass, and the equivalent regional value expected by 2020

Study	Main points	Relevance to north east
Centre for Economics and Business Research, 2006[38]	Mature industry will support 59,000 jobs and contribute £3.14 billion to the UK economy	Regional equivalent is 2,450 jobs and £130.3m (heat the main focus of the report)
Powerswitch, WWF, 2004[39]	30,000GWh electricity could be produced from biomass by 2020; value to UK by 2020 is £3 billion in today's prices, assuming no increase in cost of electricity	Regional equivalent in electricity value is £124.5m by 2020 (1,245GWh)
Biomass for heat and power in the UK, E4tech, 2003[40]	Up to 13% of the UK's electricity requirements could be supplied by biomass by 2020. This corresponds to 50,074GWh using total electricity production figures in 2006[41]	Regional equivalent in electricity value is £207.5m by 2020 (2,078GWh)

Existing studies in the UK of possible capacity focus on the UK, and we therefore use the 'proportional' rate of 4.15% to estimate possible outputs in the north east, as described in the Methodology (Section 3). Using an assumption of linear growth to 2020, it is straightforward to extract the values to the north east of electricity/heat from biomass by 2015 in each study:

[37] We place a value of 7.5p/kWh on electricity and 2.5p/kWh on heat

[38] "The economic contribution of the forest industries to the UK economy", CEBR, June 2006

[39] http://assets.panda.org/downloads/biomassfact.pdf

[40] www.berr.gov.uk/files/file22065.pdf

[41] www.berr.gov.**uk**/files/file43837.pdf, www.iea.org/Textbase/stats/unit.asp used to convert units

Table 12: Summary of predicted capacity from existing studies

Study	Installed capacity by 2015, GWh	Value to north east by 2015 (£m)
CEBR (heat)		110
Powerswitch (electricity)	830	83
E4tech (electricity)	1385	132

We therefore conclude that there is the potential for the north east to generate £107.5m from electricity generation, and £19.18m from heat generation by 2015, for a value of £126.68m. Carbon adds another £2m of value.

Comparison with Austria and Denmark

The north east has 12% of forest cover by area[42], and this can be used to extrapolate figures from European countries on biomass activities, and for the potential for the north east region. The north east consumes some 95,858.8GWh annually[43], and this statistic can be used to compare the potential biomass generation capabilities with other European regions.

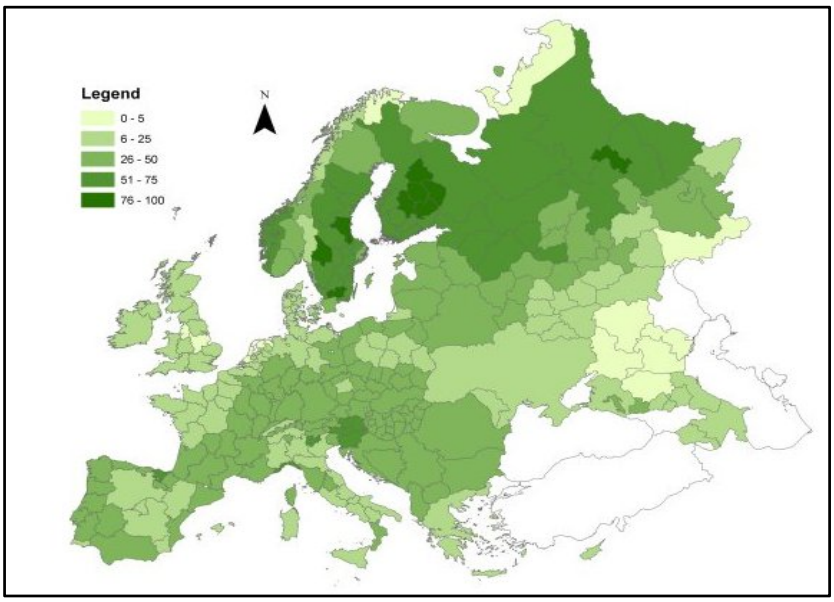

Figure 5: European forest cover (source: European Forest Institute)

A direct comparison is meaningless, as different countries have different amounts of forest cover and population densities. This will cap the potential generation capacity – Austria, for example, has a forest cover of 47%, and a population density ¼ of that of the north east, which means that the domestic fuel capacity is, to all intents and purposes, limitless in terms of a sectoral bottleneck.

Table 13: Comparison of forest cover, north east with Denmark and Austria

Country[44]	Forest cover (km^2)	Energy generated (% of national use)	Population density (/km^2)	Population per forested km^2	Ratio of 'potential supply'
North east[45]	1031	n/a	298[46]	2483	1.00
Denmark	4740[47]	12.2[48]	123[49]	1118	2.25
Austria	47[50]	10[51]	97[52]	206	12.00

[42] The Regional Forest Strategy for the North East of England, 2006
[43] www.berr.gov.uk/files/file42995.xls
[44] North east region of England included for comparison
[45] 12% forest cover, 8,592km^2 total area
[46] Northumberland Upwards; A Local Development Strategy (New Leader document)
[47] http://earthtrends.wri.org/pdf_library/country_profiles/for_cou_208.pdf; total area Denmark 43,094km^2
[48] www.nordicenergy.net/bioenergy/index.cfm?path=133 – 12.2% of total energy produced from biomass, and assumption made that 1/3 of total energy is heat, with biomass being used predominantly for that (6% of electricity in Denmark comes from biomass)
[49] http://earthtrends.wri.org/text/population-health/country-profile-50.html

Comparison with Upper Austria

The region of Upper Austria is often selected as a case study in terms of policy which has delivered high growth in renewable energy installation activity in a relatively short time – see, for example, Figure 6, which shows the cumulative capacity of biomass installations in the region between 1984 and 2007.

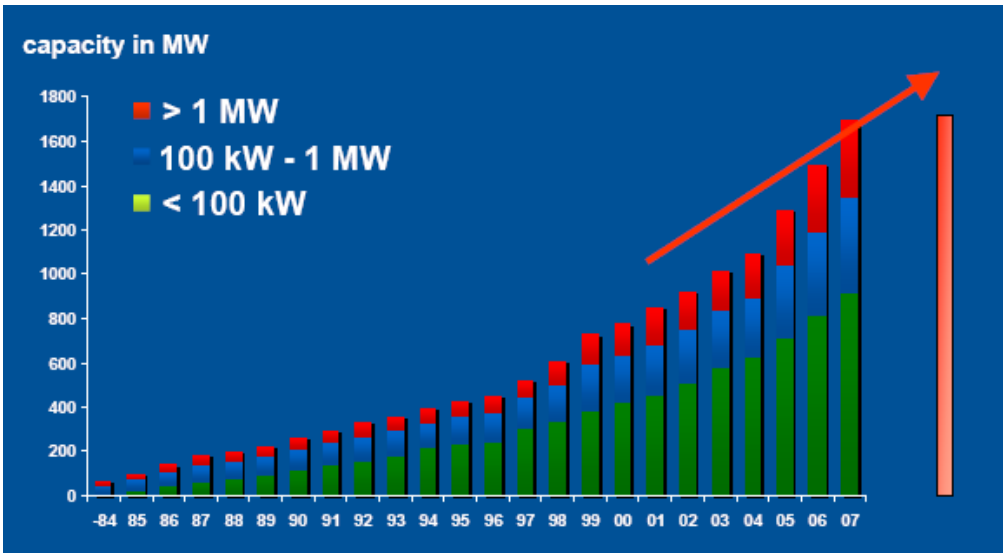

Figure 6: Installed biomass capacity in the 'Upper Austria' region[53]

Several years ago, it would have been fanciful to assume that any area of the UK could create growth rates similar to those of an Austrian region – UK policy on renewables in general, and biomass in particular has been notable by its weakness – a sad indictment of political commitment given that the UK has the best renewable resources in Europe.

Times are changing. Energy is now central to the political debate, and with the increasing awareness of climate change, the sudden and unexpected (to most) increase in the price of all major fossil fuels and the passing of the Climate Change Bill through parliament, there seems to be an opportunity to drive the renewables agenda far more strongly.

We therefore take the level of installed capacity in the north east which matches the equivalent in Austria, and project forward seven years to see what the 'potential' installed capacity could be in the north east using the Austrian region as an example.

Table 14: Comparison of Austrian biomass sector growth with the north east

Current capacity NE (MW)	Equivalent year, Upper Austria	Capacity in Upper Austria, 1992 (MW)
124	1985	350

Comparison with Denmark

Denmark has a similar level of forest cover to the north east, and therefore makes a particularly useful comparison as the infrastructure requirements would be similar for both geographical areas.

12.2% of the 820PJ[54] primary energy requirement of Denmark is currently met by biomass. An exact comparison would mean that the same percentage could be generated in the north east. This figure is 12.2% of 95,858.8GWh, or 11,503GWh. This is roughly the equivalent of 1,300MW continuous generation. If we assume that fuel supply becomes a limiting factor, and divide this by the 'potential supply' ratio of 2.25, we obtain a figure of 578MW, which is equivalent to 1,734MW installed capacity if running at 1/3 load (a compromise figure between heat-only non-industrial installations, large continuous heat generators and electricity/co-firing).

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[50] www.cbd.int/countries/?country=at, 83,872km^2 area
[51] www.energyagency.at/projekte/ren-in-a03.htm
[52] www.unece.org/stats/trend/aut.pdf
[53] www.wsed.at/wsed/fileadmin/wsed/2008/Pr_sentationen/Dell__kow_rme.pdf
[54] www.sum.uio.no/susnordic/comparative/energy_use.html

Reaching this level of generation has taken Denmark more than a quarter of a century, and we cannot assume that the north east will reach this level of installed capacity anytime soon, but this comparison does potentially indicate a target/ceiling level.

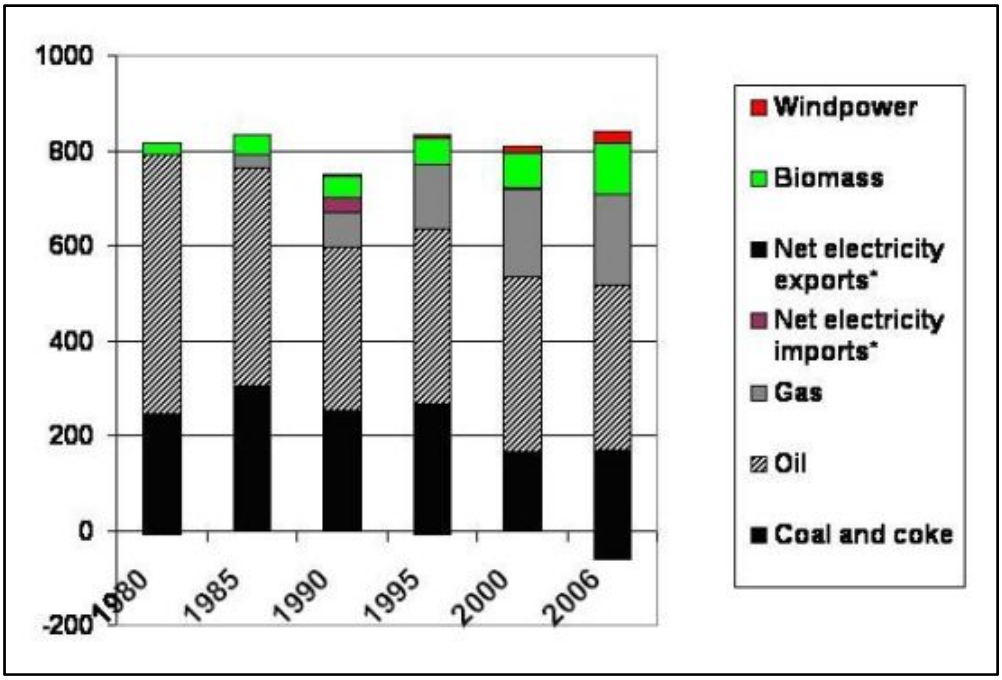


Figure 7: Primary energy requirement, Denmark

7. Appendices

Main exclusions from value calculations

Table 15: Exclusions from value calculations

Exclusion	Effect	Potential added value, 2008 (£m)	Potential increased value, 2015 (£m)
Additional value in displacement of fossil fuel value to areas outside the UK	Underestimate of value to the region and the UK	Unquantifiable	Unquantifiable
Additional value in displacement of fossil fuel costs to the local area	Small effect in 2008, significant in 2015 with rising fossil fuel costs	Marginal	Significant but unquantifiable
Number of domestic users unknown	Marginal underestimate of biomass value[55]	0.02	0.07
True value of biomass used at large plants in the region not known with certainty	Referenceable figure grossly underestimates true value	8.05	8.05
Alcan generation figures from biomass unknown, therefore not counted	Potentially large underestimate of electricity and ROC value[56]	2.67	3.34
Carbon value used is that of ETS; Stern report value would be much greater	Large reduction in total depending on value of CO_2 used	2.56	2.56
Reduced external costs accounts only for the Sembcorp plant, not for displacement of other fossil fuel plant	Large underestimate of reduced morbidity and mortality costs[57]	1.98	2.29
No economic value ascribed to the improved educational standards of students	Low underestimate of economic benefit	Unquantifiable	Unquantifiable
Additional forestry sector training which gets used in the biomass sector not included	Marginal	Marginal	Marginal
Total		**15.28**	**16.31**

[55] 4.15% of domestic biomass in 2006 is equivalent to 0.007Mtoe, or 814,100kWh, valued at 2.5p/kWh

[56] Assume 10% of Alcan's output is produced from biomass; 70% capacity factor gives 23,317MWh annual electricity generation, for £0.8m ROC value (£0.95m by 2015) and £1.87m for electricity value (£2.39 by 2015)

[57] Assume that all displaced fossil fuel is mains gas, with a displacement value compared to biomass of 0.6p/kWh of heating, and total availability of plant in the region (excluding the Sembcorp plant) is 40% of 94MW for a total of 329,600MWh

Comparison of value of biomass with coal to the north east economy

Data from 2007-2008 on outputs from mines in the UK and the north east has been used to estimate the output of the north east as a proportion of the UK over the last 20 years[58] (approximately 8.6% of UK production in 2007-2008 came from the north east). This has then been compared with the figures produced in this report of biomass used in the north east.

In some ways this is a false comparison; a direct one would compare production of coal with production of biomass; in the absence of directly available figures of biomass production from the north east, we use consumption figures and accept that this is of illustrative value only.

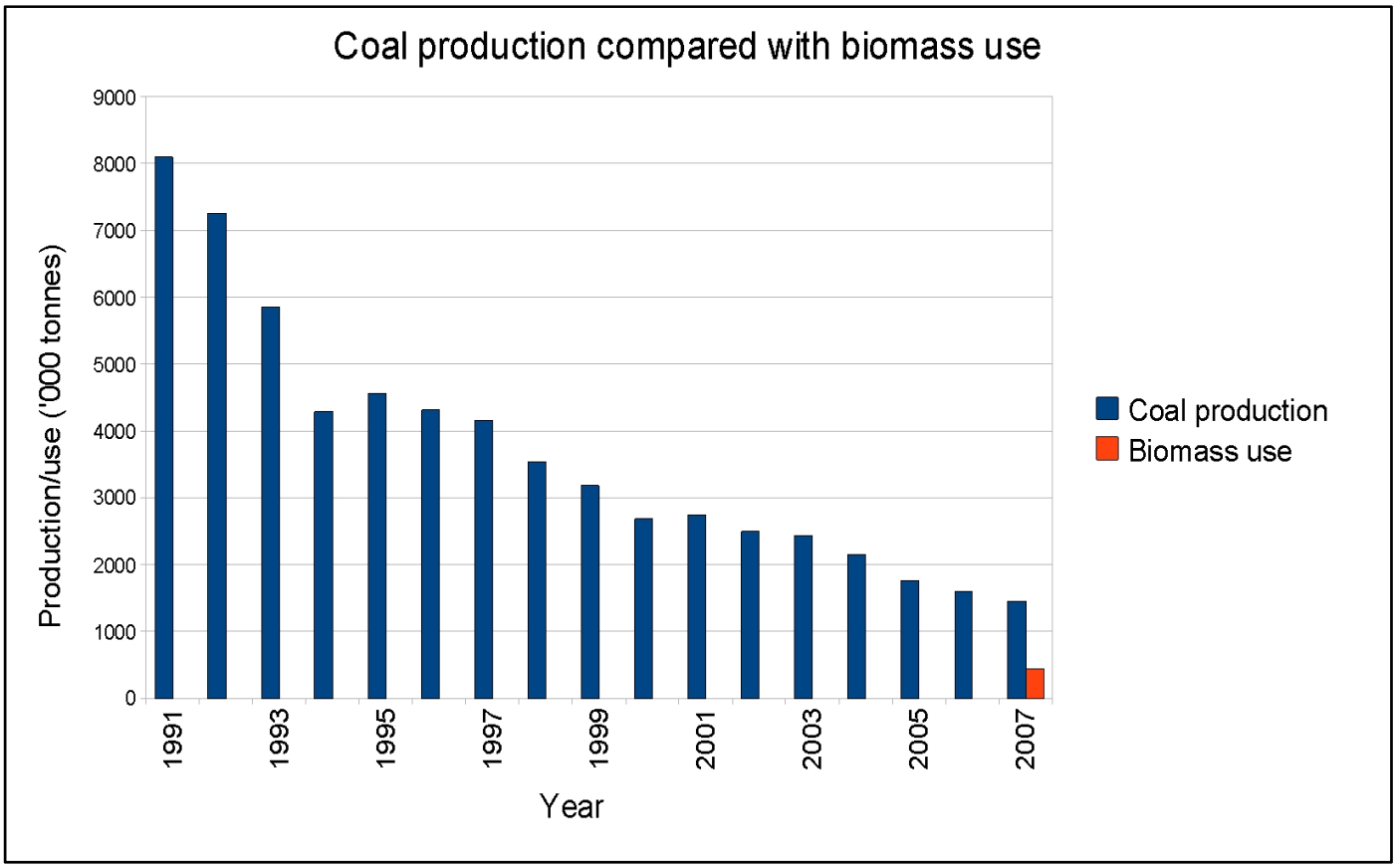


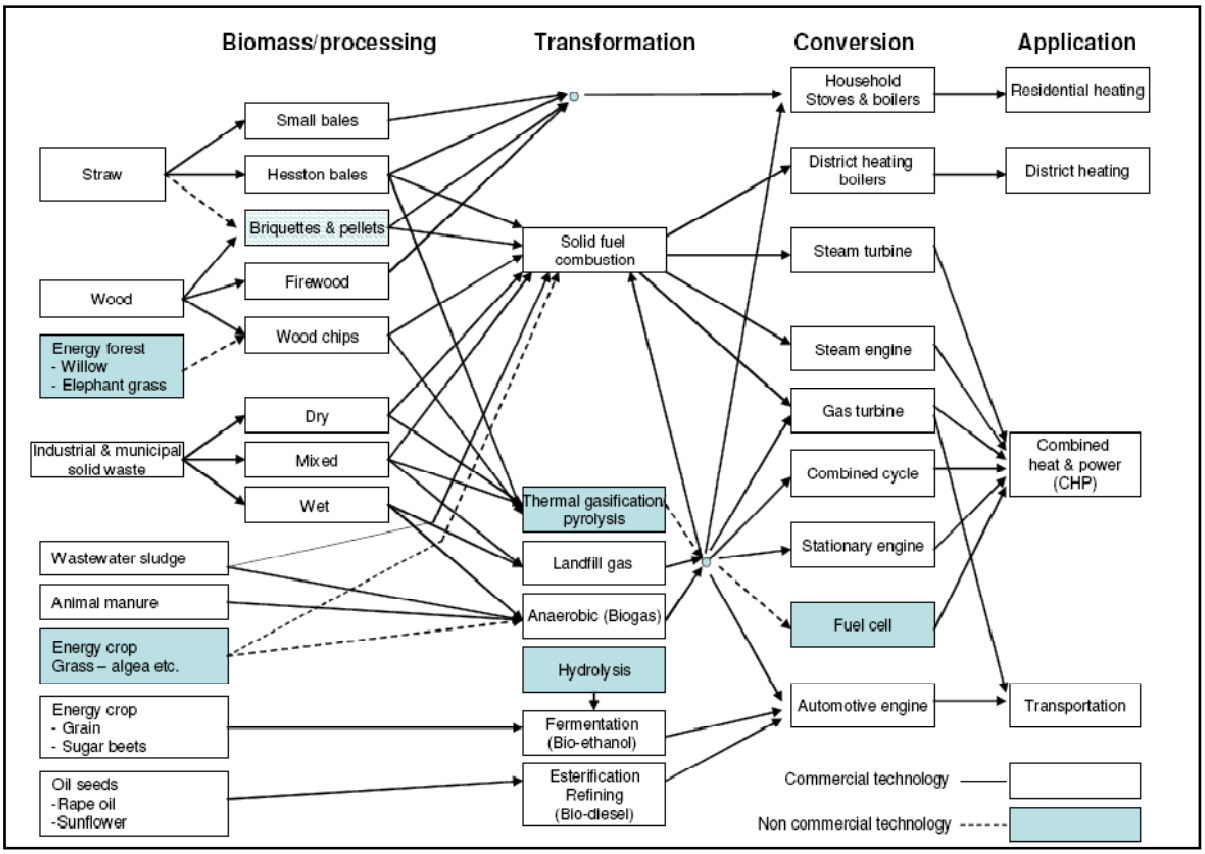
Figure 8: Comparison of coal production to biomass use in the north east

Given that the biomass sector in the north east is undergoing expansion, and that the coal sector is experiencing long-term decline, it seems inevitable that a crossover will happen in the coming years, and that biomass will be the more important commodity to the north east over the short to medium term, both in terms of employment and economic value.

[58] www.coal.gov.uk/media//3839D/CSum%20FY2007-08.pdf; www.berr.gov.uk/energy/statistics/publications/dukes/page45537.html

Bioenergy value chain

The following diagram[59] gives an indication of the processes and sectors which could be involved with a thriving biomass industry.



Installer questionnaire

Spreadsheet questionnaire sent out to named installation companies in the region

Company name	
Number of installations in north east region, Jan 2007-Dec 2007	
Total installed capacity (MW), Jan 2007-Dec 2007	
Value to company of NE installations (rough figure)	
Likely level of increase of activity in 2008 (% increase)	
Long-term predicted increase of activity (to 2015 – leave blank if impossible to predict)	
If no prediction for the above, do you think you will be more or less busy by 2015?	

Acknowledgements

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- Toasty Heating
- Econergy

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[59] www.nordicenergy.net/bioenergy/_upl/bioenergy_technology_value_chain_web_memo_050907.pdf

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