- *The use of wood biomass for domestic and commercial heating grew by 41% in 2008 to reach 586,000 m^3, most of which was used as process energy in the forest products sector.*
- *The total energy output from wood biomass in 2008 was an estimated 4.97 PJ or 119,000 tonnes of oil equivalent (TOE).*
- *Heat was the largest component of wood biomass energy output (4.86 PJ).*
- *Accountable carbon dioxide emission savings were an estimated 380,000 tonnes.*

An overview of the Irish wood-based biomass sector in 2007-2009

Gordon Knaggs and Eoin O'Driscoll*

Summary overview[1]

Renewable energy use in Ireland grew by 182% over the period 1990-2007, due largely to an increasing contribution from wind energy[2]. The share of primary energy consumption, supplied by renewables increased from 2.7% in 2006 to 3.7% in 2008[3] (Table 1).

Renewable thermal energy is dominated by biomass, in particular the use of waste wood to generate process heat during the manufacture of wood-based panels (WBP), as well as in sawmilling and at other wood processing plants.

Table 1: Contribution of renewables to TPER[a] (in PJ) for 2008.

Renewable energy source	PJ[b]	%	% TPER[c]
Wind	8.67	36	1.31
Biomass	7.45	31	1.13
of which:			
Wood[d]	5.36	22	0.81
Tallow/MBM[e]	2.09	9	0.32
Hydro	3.48	14	0.53
Other	4.72	19	0.71
of which:			
Landfill gas	1.08	4	0.16
Biogas	0.38	2	0.06
Liquid biofuel	2.30	9	0.35
Solar	0.12	0	0.02
Geothermal	0.84	3	0.13
Total	**24.32**	**100**	**3.68**

[a] TPER: Total Primary Energy Requirement, the total amount of energy used in an economy within any given year.

[b] PJ = Peta Joule.

[c] Source: SEAI Renewable Energy in Ireland 2008 Report; Focus on wind energy and bio-fuels; www.seai.ie/Publications/Statistics_Publications/SEI_Renewable_Energy_2008_Update/Renewable%20Energy%20Update%202008.pdf.

[d] Irish Joint Wood Energy Enquiry (JWEE) [2007 – 2009].

[e] MBM: Meat and bone meal.

[1] *www.seai.ie/Publications/Statistics_Publications/SEI_Renewable_Energy_2008_Update/Renewable%20Energy%20Update%202008.pdf*

[2] *www.seai.ie/Publications/Statistics_Publications/SEI_Renewable_Energy_2008_Update/Renewable%20Energy%20Update%202008.pdf*

[3] *Source: Sustainable Energy Authority Ireland (SEAI); www.seai.ie*

COFORD
Dept. Agriculture, Fisheries & Food
Agriculture House, Kildare Street
Dublin 2, Ireland
Telephone: +353 1 607 2487
Email: info@coford.ie
http://www.coford.ie

* *Email: gordonknaggs@eircom.net; eoin@drima.com.*

There is significant potential to develop Ireland's bioenergy resources. This includes wood biomass to displace fossil fuel, particularly for the generation of heat.

Wood biomass use in Ireland

The largest use of wood biomass for energy is in the forest products sector, where it is used for process heat and energy. However, wood energy use in the commercial and domestic sectors has increased considerably since 2006 (Table 2).

Developments such as the Clare Wood Energy Project (CWEP)[4] show that wood energy provides new markets for roundwood from farm woodlands. Overall, the use of wood biomass for domestic and commercial heating grew by 41% in 2008 (Table 3).

The energy output from wood biomass showed a slight fall in 2008 (Table 4). This was largely due to a reduction in the output of the Irish wood-based panel (WBP) sector. In 2008, the requirement for wood biomass use by this sector declined in line with the decline in WBP output.

The increased electrical energy output from biomass (51 to 112 TJ) was due to co-firing of milled peat with wood biomass at the Bord na Móna plant at Edenderry[5,6].

Biomass policy drivers

The Bioenergy Action Plan[7] aims to increase the use of renewable energy in three key sectors: transport, heat and electricity. Targets include:

- By 2020, a third of all electricity consumed in Ireland will be generated from renewable sources. This target has since been increased to 40%[8].
- By 2020, all peat-fired power generation stations will be co-fired to a level of 30% with biomass.
- By 2020, 12% of the total heating (process, space, water, etc.) in all sectors is to be provided by renewable sources.

The use of biomass in power generation will be supported by means of technology transfer, by investment in specific research and development programmes and by tackling supply issues.

The need to develop Combined Heat and Power (CHP) and district heating schemes has been identified as an area where energy efficiency could be improved. CHP output targets are shown in Table 5.

Table 2: Wood biomass end use in Ireland (2007-2008)[a,b].

Biomass type	End use	000 m^3 [roundwood equivalent]	
		2007	2008
Firewood	Domestic heating	44	54
Wood chips	Commercial heating	35	63
Short rotation coppice (SRC)	Commercial heating	1	1
Wood pellets and briquettes	Domestic and commercial heating	67	82
Charcoal	Domestic use	2	2
Biomass use by the energy[c] and forest products industry	Process drying/ heating/CHP	420	384
Total		569	586
Use in the forest products sector (%)		74	66

a Source: EUROSTAT JWEE return for Ireland (2008 and 2009).

b Biomass usage is reported in cubic metres (roundwood equivalent).

c This includes co-firing of wood biomass at Edenderry Power.

Table 3: Wood biomass use in domestic and commercial heating (2007-2008)[a,b,c].

Feedstock	**Biomass input in 000 m^3 [roundwood equivalent]**	
	2007	**2008**
Firewood	44	54
Woodchips	35	63
Wood pellets and briquettes	30	37
Short rotation coppice (SRC)	1	1
Total	**110**	**155**

[a] Source: Joint Wood Energy Enquiry [JWEE] (2009).

[b] Inputs into the forest products sector are excluded.

[c] Biomass use is in cubic metres of roundwood equivalent.

Table 4: Energy output from wood biomass and estimated equivalent carbon dioxide emissions abated (2007–2008)[a].

Item	**Output**	
	2007	**2008**
	TJ	
Heat	4,931	4,857
Electricity	51	112
Total	4,982	4,969
CO_2 abated (000 t)	381	380

[a] Source: UNECE Joint Wood Energy Enquiry (JWEE) [2008 - 2009].

4 *www.ccwep.ie*
5 *www.edenderrypower.ie/default.asp*
6 *Bord na Móna Annual Report (2008 / 2009); page 5; bnm.annualreport08-09.com/BNM_AnnualReport08-09.pdf*
7 *www.dcmnr.gov.ie/NR/rdonlyres/4FFF6234-26CA-46B5-878AA04A7288DA4/0/FinalBioenergyReport.pdf*
8 *www.cer.ie/GetAttachment.aspx?id=a9985f53-2ce1-4a17-b98d*

The Energy White Paper[9] sets targets for CHP output (Table 5). No specific target has been set for biomass CHP[10].

Under the Climate Change and Renewable Energy Directive[11], Ireland's renewable energy target is 16% of final energy consumption by 2020[12].

Table 5: Combined heat and power targets to 2020[a,b].

Item/Year	Unit	2010	2020
Target for CHP generated electricity	MWe	400	800
Target for CHP generated heat	%	5	12

[a] The targets for 'biomass generated electricity' in this table are the targets for CHP with an 'emphasis on biomass CHP', i.e. they include fossil fired CHP. No specific target has been set for biomass CHP.

[b] www.seai.ie/Publications/Statistics_Publications/EPSSU_Publications/CHP_in_Ireland_2007_Fnl_rpt.pdf

Promoting wood energy use

It is estimated that 11.36 PJ (272 ktoe[13]) of renewable heat energy will be required in 2010 to meet the target for thermal applications[14].

In 2006, the Irish government introduced a 5-year capital programme to underpin the growth of the Irish renewable heat sector. Grant schemes have been developed in conjunction with Sustainable Energy Authority Ireland (SEAI). The total funding package is €89 million. The schemes within the programme include the CHP grant scheme, the Greener Homes Scheme (GHS), the ReHeat programme and REFIT.

Combined heat and power (CHP) grant scheme[15]

This programme provides grants for the installation of CHP units. It aims to develop small-scale CHP units (up to 1 MW) fired by fossil fuels that can be deployed in buildings with a substantial heat requirement. A second strand covers grant-aid for biomass-fired CHP. The new SEAI Biomass CHP/AD[16] scheme has an indicative budget of €5-8 million. This provides grant support to assist the deployment of biomass CHP systems.

The programme aims to deliver 10-15 MWe biomass CHP, and 10-20 MWe of electricity from small-scale fossil fuel CHP. There is no limit on the size of installations that can be grant-aided if they are fuelled by biomass. To date, one biomass CHP project has been commissioned[17]. A number of others are in the feasibility stage.

Existing biomass-fuelled Combined Heat and Power (CHP) installations

There are currently two wood-fuelled biomass CHP plants in operation - at Grainger Sawmills and Munster Joinery[18]. Both are steam turbine based (Table 6).

Table 6: Biomass fuelled CHP output in the Republic of Ireland (2008).

Plant name and location	Feedstock	Rated electricity output MWe	Rated heat output MWth
Grainger Sawmills, Enniskeane, Co Cork[a,b]	Sawmill residues	1.8	7.9
Munster Joinery Ltd., Ballydesmond, Co Cork[c]	Joinery residues	3.0	11.0
Total		4.8	18.9

[a] www.graingersawmills.com/chp.htm

[b] www.seai.ie/uploadedfiles/RenewableEnergy/Document4Amended.pdf

[c] www.seai.ie/Your_Business/Large_Industry_Energy_Network/Workshop_Presentations/John_Fingleton-_CHP_Projects.pdf

Co-firing with biomass

A target of 40% of electricity consumption being from renewable sources by 2020 has been set[19]. The ESB and Bord na Móna[20] have been tasked to work with the biomass sector to develop the potential of co-firing (with biomass) at the three state-owned peat burning power stations[21].

9 *www.dcmnr.gov.ie/Energy/Energy+Planning+Division/Energy+White+Paper.htm*

10 *Source: Sustainable Energy Authoroty Ireland (SEAI); www.seai.ie/Publications/Statistics_Publications/EPSSU_Publications/CHP_in_Ireland_2007_Fnl_rpt.pdf*

11 *Official Journal of the European Union, L140/16 to L140/62, 5.6.2009.*

12 *Source: Sustainable Energy Authority Ireland (SEAI); www.seai.ie*

13 *ktoe = 1,000 tonnes of oil equivalent.*

14 *Source: Sustainable Energy Authority Ireland (SEAI); www.seai.ie*

15 *www.seai.ie/chpgrants/*

16 *AD: Anaerobic digestion.*

17 *Operated by Munster Joinery Ltd.; www.munsterjoinery.ie/index.html*

18 *www.fingleton.ie/pdf/chp/672-MUNSTER-JOINERY-CHP.pdf*

19 *Irish carbon budget (2008)*

20 *Bord na Móna supply milled peat to three thermal power plants, owned by the Electricity Supply Board and Bord na Móna www.bnm.ie*

21 *Edenderry, Lough Ree and West Offaly*

Biomass for households and medium-sized businesses

In recent years, wood biomass systems have been promoted and developed for use in households and in medium-sized industrial premises by state agencies including COFORD[22], the Forest Service[23], Teagasc[24] and Sustainable Energy Authority Ireland (SEAI)[25]. The volume of wood biomass used for the heating of domestic and light industrial premises is shown in Table 3.

Greener Homes Scheme (GHS)[26]

The scheme was established in 2006. It provides grants for the installation of renewable heat technologies including wood pellet stoves, boilers, solar panels and geothermal heat pumps. Up to February 2009, over 26,000 applications had been approved (Table 7).

Table 7: Uptake of the Greener Homes Scheme to February 2009[a].

Energy source	% of grant approvals
Solar	54
Heat pump	23
Biomass	23

[a] Source: SEAI; www.seai.ie

ReHeat Programme[27]

The scheme enables community groups as well as commercial, public and industrial sector organisations to obtain grants for the installation of wood chip and wood pellet boilers. Grant-aid is up to 30% of overall cost. By June 2009, 142 biomass projects were grant-aided with a total output potential of 60.74 MW. The average biomass boiler installed had a heat output potential of 428 kW[28].

Renewable Energy Feed-In Tariff (REFIT)[29]

The REFIT scheme was launched in May 2006. It provides support to renewable energy projects over a 15-year period. The new support mechanism differs from the previous programme in that it operates as a fixed feed-in tariff, rather than as a competitive tendering process. Applicants must have planning permission and a grid connection offer for their projects. Once these are in place the energy provider can enter into a contract with any licensed electricity supplier up to the notified fixed prices.

The fixed price tariffs are:

Large wind energy (over 5 MW)	5.7 cent/kWh[30]
Small wind energy (under 5 MW)	5.9 cent/kWh
Biomass (landfill gas)	7.0 cent/kWh
Hydro and other biomass technologies	7.2 cent/kWh

In September 2009, Minister Eamon Ryan T.D. announced that the REFIT tariff for biomass CHP of 12 cent/kWh[31], initially announced in January 2008 would be available for applicants for a 15 year period to 2025[32,33].

Raw material supply

Private sector roundwood/energy assortment supply[34]

According to the National Forest Inventory (NFI)[35], in 2008, the area of privately-owned forest was 320,000 ha.

Over the period 1981-2008, 232,000 ha were established by private growers, 84% of whom are farmers; 212,000 ha have been planted since 1990[36].

The total growing stock for the Irish private forest estate was estimated as 18.5 million m^3 of roundwood[37].

[22] *www.woodenergy.ie/iopen24/*
[23] *www.agriculture.gov.ie/forestry/woodbiomasscheme/biomassscheme.pdf*
[24] *www.teagasc.ie/forestry/wood_energy/*
[25] *www.seai.ie/Renewables/Wood_Energy/*
[26] *www.seai.ie/greenerhomes/*
[27] *www.seai.ie/reheat/*
[28] *www.seai.ie/Grants/Renewable_Heat_Deployment_Programme/List%20of%20Organisations%20supported%20by%20ReHeat%20programme%20Oct08.pdf*
[29] *www.seai.ie/index.asp?docID=-1&locID=1213*
[30] *kWh: Kilowatt hour.*
[31] *kWh: Kilowatt hour.*
[32] *www.dcenr.gov.ie/NR/rdonlyres/3B13ECAA-9351-41E0-8B44-7C02E98E4F50/0/AdditionalREFITcetegories.pdf*
[33] *www.dcenr.gov.ie/Press+Releases/15+year+support+for+renewable+energy+sector.htm*
[34] *www.coford.ie/iopen24/pub/forecast-fnl.pdf*
[35] *www.agriculture.irlgov.ie/media/migration/forestry/nationalforestinventory/nationalforestinventorypublications/4330NFIResults.pdf*
[36] *www.teagasc.ie/forestry/docs/technical_info/articles/IUFRO%20The%20Farm%20Forest%20Resource%20&%20Rural%20Development%20in%20Ireland%202006.pdf*

Most of the private forest estate has been established over the past two decades, with many areas now entering the first thinning stage.

The COFORD publication *Roundwood production from private sector forests 2009-2028 - A geospatial forecast* shows a potential eight-fold increase in roundwood production from privately-owned forests over the next two decades (0.38 million m^3 in 2009 to 2.95 million m^3 by 2028)[38].

The potential for biomass energy production from private forests is shown in Table 8[39]. These include an estimate of the biomass potential which is present in that part of the crop which is not currently harvested. Such products include tree tops, stumps, roots and branches.

Realising the potential expansion in production will entail significant capital investment in roads, harvesting equipment and information technology systems by forest owners, contractors and by the state.

The total thinning area, from first, second, third and subsequent thinnings, increases over time and peaks at circa 30,000 ha in 2022. This scale of thinning, to be achieved within the next thirteen years, represents a significant challenge.

Given the disperse nature of the private forest resource and the small average plantation size, innovation in wood procurement, harvesting and transport is essential to drive down costs, reduce measurement overheads and eliminate double handling.

Table 8: Forecasted roundwood production from the private sector forest estate (2009 to 2028).

Year/TD[a]	Net volume in 000 m^3 overbark				Potential energy volume[b] 000 m^3
	7–13 cm	14–20 cm	> 20 cm	Total	
2009	257	11	15	381	302
2014	330	209	56	595	388
2019	515	362	209	1,086	607
2024	576	627	539	1,793	675
2028	530	951	1,472	2,953	626

[a] TD: top diameter.

[b] Energy forecast data is based on the use of biomass expansion factors (BEF).

Projections to 2020 indicate that a supply of 4 million green tonnes of biomass will be required per annum to meet Irish government targets for biomass use. It is unlikely that the forest sector could supply more than half of this volume – the challenge of achieving the heat and co-firing targets alone would require 3.1 million tonnes of wood chip at 50% moisture content[40]. These targets highlight the need for a substantial increase in the rate of afforestation, allied to increased wood fibre output from short rotation forestry, coppice and harvesting residues.

Sustaining wood fuel production beyond 2020 is dependent on a continuation of policy measures and on the level of afforestation over the next two decades. Wood fuels are mainly sourced from young forests. A balanced age class structure is therefore a prerequisite for sustained supply of wood fuel. To provide a sustainable biomass supply, an annual afforestation programme of at least 10,000 ha per year needs to be put in place for an extended period of up to two decades. If annual afforestation rates continue to fall below 10,000 ha per annum, wood fuel supply will not be sustainable in the long term and government biomass targets will not be attained.

Use of forest harvesting residues for biomass[41]

Forest harvesting residues include branches and tops, stump wood and un-merchantable roundwood left in the forest after harvesting operations have been completed[42].

Coillte has examined the economic viability of recovering forest residues from its clearfell sites. It has estimated that forest residues could supply between 80,000 and 150,000 tonnes/year[43].

[37] *www.coford.ie/iopen24/pub/forecast-fnl.pdf*

[38] *Roundwood production from private sector forests 2009-2028. A geospatial forecast ; Authors: Henry Phillips, John Redmond, Máirtín Mac Siúrtáin and Anita Nemesova; http://www.coford.ie/iopen24/pub/forecast-fnl.pdf*

[39] *www.coford.ie/iopen24/pub/be09-phillips.pdf*

[40] *www.coford.ie/iopen24/pub/nfc09-crowley.pdf*

[41] *www.coford.ie/iopen24/pub/nfc09-crowley.pdf*

[42] *www.eubia.org/191.0.html*

[43] *www.coford.ie/iopen24/pub/nfc09-crowley.pdf*

Biomass fuel costs

The forest industry is rapidly developing a range of quality wood fuels, which includes high quality firewood as well as refined products such as wood chip and pellets. Wood pellets are increasingly being used for domestic heating. A survey undertaken in July 2009 by SEAI found that the use of wood biomass for industrial space heating provides significant savings over oil, gas and electricity (Table 9).

A presentation at BioEnergy 2009 by the Health Service Executive (HSE)[44], showed prices the agency paid for energy (Table 10).

Table 9: A comparison of energy costs for industrial space heating (July 2009)[a].

Fuel	Delivered energy cost cent/kWh[b]
Oil	
Gas oil	6.33
Light fuel oil	5.71
Medium fuel oil	5.44
Heavy fuel oil	5.26
LPG[c]	
Commercial cylinders	11.59
Bulk LPG (0-3 tonnes)	8.41
Bulk LPG (3-40 tonnes)	7.66
Natural gas	
Small business < 73,000	5.46
Medium business > 73,000	3.65
Electricity PES[d] tariffs[e]	
General purpose up to 131 kWh/day	18.95
General purpose over 131 kWh/day	17.07
General purpose night saver up to 131 kWh/day	19.42
General purpose night saver over 131 kWh/day	18.24
General purpose night saver-night rate	8.71
Low voltage low load factor (day)	17.69
Maximum demand low voltage	15.90
Wood	
Wood chip[f]	3.00
Pellets loose	3.70
Pellets bagged	6.05

[a] www.seai.ie/Publications/Statistics_Publications/Fuel_Cost_Comparison/Commercial_Fuel_Cost_Comparison_July_2009.pdf

[b] kWh: Kilo Watt Hour.

[c] LPG: Liquid petroleum gas.

[d] PES: Public electricity supplier.

[e] www.cer.ie/GetAttachment.aspx?id=29fb8e92-703b-4ca7-acfa

[f] Wood chips at a maximum 35% moisture content.

Table 10: Energy prices as paid by the Health Service Executive[a].

Fuel type	Energy price cent/kWh (June 2009)
Oil	3.0-4.2
Natural gas	2.5-3.5
Wood pellets	3.3-3.6
Wood chip	2.5

[a] www.coford.ie/iopen24/pub/be09-deering.pdf

Wood fuel quality assurance scheme

The Irish Bioenergy Association (IrBEA)[45] in collaboration with industry, SEAI and COFORD is developing a wood fuel quality assurance scheme[46]. The aim is to provide customers with the confidence that they are purchasing a quality wood fuel from a sustainable source relevant to their needs[47]. The scheme will be launched in 2010.

New wood pellet manufacturing plants

Until 2008, Balcas was the sole manufacturer of wood pellets on the island of Ireland. D Pellet Ltd[48], the first wood pellet production facility to operate in the Republic of Ireland, commenced production in 2008. The plant is located at Knocktopher, Co Kilkenny, and has a production capacity of 75,000 tonnes of wood pellets per annum.

In early 2009, Laois Sawmills commenced the production of wood pellets at its Portlaoise sawmill. It is currently supplying in bulk form.

In May 2009, Imperative Energy[49] announced that it was in the process of building a wood pellet, bio-refining and CHP facility at Claremorris, Co Mayo. When fully operational, this facility will have the capacity to produce 60,000 tonnes of wood pellet/annum, together with a 15 MWth[50]/5 MWe[51] CHP plant. Imperative's plans for its Claremorris site also include the development of a bio-processing plant with an annual intake capacity of 20,000 tonnes. This will convert straw and wood biomass into bio-based products including ethanol, lactic acid, lignin, methane and hydrogen[52].

[44] *www.coford.ie/iopen24/pub/be09-deering.pdf*

[45] *www.irbea.org*

[46] *www.thebioenergysite.com/articles/contents/irish_bioenergy_conf.pdf*

[47] *www.coford.ie/iopen24/pub/be09-obrien.pdf*

[48] *www.dpellet.ie/index.html*

[49] *www.imperativeenergy.ie*

[50] *MWth: megawatt thermal energy.*

[51] *MWe: megawatt electrical power.*

[52] *www.biospark.ie/the_project.php*