- *In 2007, the output of the Irish renewable primary energy sector grew by 12%.*
- *There is significant potential to develop Ireland's bioenergy resources. This includes the potential for wood biomass to displace fossil fuel, particularly for the generation of heat.*
- *In 2007, the use of wood biomass reduced Ireland's greenhouse gas (GHG) emissions by 369,000 tonnes of CO_2.*
- *Case studies highlight the use of wood biomass in new industrial markets.*

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An overview of the Irish wood-based biomass sector 2007

Gordon Knaggs[1] and Eoin O'Driscoll[2]

In 2008, COFORD undertook a review of the production and use of wood biomass in Ireland. Ireland has significant potential to develop its bioenergy resources to generate electricity, for use as transport fuels, to provide heating for buildings and for conversion to biochemicals as industrial raw materials[3]. This COFORD Connects note examines the wood-based biomass market in Ireland.

Renewable energy use in Ireland[4]

The output of the Irish renewable energy sector grew by 182% over the period 1990 – 2007. The share of primary energy consumption, supplied by renewables increased from 2.7% in 2006 to 2.9% in 2007[5]. The renewable energy sources which contributed to this 2.9% total are outlined in Table 1.

Renewable thermal energy is dominated by biomass, in particular the use of waste wood to produce thermal energy during the manufacture of wood-based panels (WBP), in sawmills and at wood processing plants. Thermal biomass energy is also produced using tallow from rendering plants. In 2007, the output of the Irish renewable primary energy sector grew by 12%. Renewable energy

Table 1: Contribution of renewables to TPER[6] (in PJ) for 2007.

Renewable energy type		PJ [7]	%	% TPER [8]
Wind		7.03	37.67	1.00
Biomass		7.16	38.35	1.10
	Wood[9]	4.82	25.79	0.75
	Tallow	2.34	12.56	0.35
Hydro		2.39	12.77	0.40
Other		2.09	11.21	0.40
	Landfill gas	1.00	5.38	
	Biogas	0.42	2.24	
	Liquid biofuel	0.63	3.36	
Solar		0.04	0.22	
Total		18.67	100.00	2.90

1 *Forest Products Consultant; email gordonknaggs@eircom.net*
2 *Consultant; email eoin@drima.com*
3 *BioEnergy Action Plan for Ireland. www.dcmnr.gov.ie/NR/rdonlyres/4FFF6234-26CA-46B5-878A-AA04A7288DA4/0/FinalBioenergyReport.pdf*
4 *http://www.sei.ie/Publications/Statistics_Publications/SEI_Renewable_Energy_2008_Update/Renewable%20Energy%20Update%202008.pdf*
5 *Source: Sustainable Energy Ireland (SEI) www.sei.ie*
6 *TPER: Total Primary Energy Requirement, the total amount of energy used in an economy within any given year*
7 *PJ = Peta Joule*
8 *Source: SEI Renewable Energy in Ireland 2008 Report; Focus on wind energy and bio-fuels. www.sei.ie/Publications/Statistics_Publications/SEI_Renewable_Energy_2008_Update/Renewable%20Energy%20Update%202008.pdf*
9 *Irish Joint Wood Energy Enquiry (JWEE) return for 2007/8*

accounted for 2.9% of Ireland's total primary energy requirement (TPER). The estimated amount of CO_2 emissions avoided due to the use of renewable energy was 2.1 million tonnes (Table 2).

Table 2: CO_2 emissions avoided by the use of renewable energy in Ireland (2007).[10]

Renewable energy type	Emissions avoided kt CO_2 per annum
Wind	997
Solid biomass[11]	585
Hydro	339
Other	179
Total	2,100

It is estimated that 272 ktoe[12] of renewable heat energy will be required in 2010 to meet the renewable energy target for thermal applications[13].

Under the proposed EU renewable energy directive[14], Ireland's target for 2020 is for renewable energy sources to provide 16% of final energy consumption[15].

Wood biomass output

In 2007, the total energy produced from biomass in Ireland was 115,288 tonnes of oil equivalent (toe). The market for wood biomass in Ireland is dominated by the sawmilling and wood-based panel (WBP) sectors. However, the downturn in construction output in both domestic and export markets has reduced the demand for biomass fuel from this sector. The Irish forest products sector uses sawmill residues, WBP residues[16] and post-consumer recovered wood (PCRW)[17] to generate the heat and electricity required for their drying and processing facilities. For example, Medite Europe Ltd[18] manufactures medium density fireboard (MDF) at its facility at Clonmel, Co Tipperary. The feedstock is dried using a biomass fuelled drying system, with an output of 19 MW[19].

The feedstock used to supply the wood biomass requirements of the Irish forest products sector is shown in Table 3.

The domestic and industrial use of wood biomass grew significantly in 2007, fuelled by the uptake of SEI grants and by those wishing to avail of a cheaper alternative to fossil fuels. This was largely driven by a significant increase in the importation and use of wood pellets. The annual heat and electricity output produced by the Irish biomass sector in 2007 is shown in Table 4.

Wood biomass use and CO_2 savings[20]

In 2007, the use of wood biomass in Ireland had a combined heat output of 4,776 TJ[21]. This equates to 115,244 tonnes of oil equivalent (toe)[22]. As wood biomass is carbon neutral, this equates to a greenhouse gas (GHG) saving of 369,000 tonnes of CO_2.

Table 3: Feedstock used to supply the wood-based biomass sector in Ireland (2007).[23]

Item	Unit	Annual feedstock usage
Fuelwood	m^3 underbark	31,867
Short rotation coppice (SRC) harvested	m^3 underbark	4,436
Wood residues used for energy by the forest products sectors	m^3 underbark	194,705
Bark used for energy by the forest products sector	m^3 underbark	91,439
Wood residues used for domestic energy	m^3 underbark	4,880
Post-consumer recovered wood (PCRW) used for energy by the forest products sector[24]	Air dried tonnes	52,942

10 *Source: SEI*

11 *This includes wood biomass and tallow*

12 *ktoe = 1,000 tonnes of oil equivalent*

13 *Source: Sustainable Energy Ireland (SEI) www.sei.ie*

14 *ec.europa.eu/energy/climate_actions/doc/2008_res_directive_en.pdf*

15 *Source: Sustainable Energy Ireland (SEI) www.sei.ie*

16 *Residues produced during the production of wood-based panels (WBP)*

17 *PCRW: post consumer recovered wood*

18 *www.medite-europe.com*

19 *http://www.sei.ie/uploadedfiles/RenewableEnergy/REIOBiomassFactsheet.pdf*

20 *UNECE Joint Wood Energy Enquiry [JWEE] for Ireland (2008)*

21 *TJ: Tera joule ; 1 TJ = 278,000 kWh*

22 *Tonne of oil equivalent (toe); this is a standardised unit of energy use. It is defined on the basis of a tonne of oil having a net calorific value of 41,686 kJ/kg*

23 *http://www.sei.ie/uploadedfiles/RenewableEnergy/REIOBiomassFactsheet.pdf*

24 *This is equivalent to 135,000 m^3 UB*

Table 4: The heat and electricity output produced by the use of wood biomass use in Ireland (2007).[25]

Sector	Item	Heat Output TJ	Electricity Output TJ	Total output TJ
Forest products sector	Heat output	3,868		3,868
Forest products sector	Electricity output		51	51
Domestic heating	Heat output	784		784
Commercial heating	Heat output	124		124
Total		4,776	51	4,827

Why wood pellets?

Wood pellets are a clean, dry fuel made from a mixture of sawdust and wood shavings. They provide a high energy, smoke free fuel. Unlike other solid fuels, they are easy to handle and create almost no ash. Pellets are commonly available in bags of 10 to 15 kg, at a cost of €2 to €4 per bag[26]. They are increasingly being used to fuel domestic heating systems. In 2007, 25,000 tonnes of wood pellets were imported. This market has grown significantly since 2006. A list of wood pellet suppliers in Ireland can be downloaded from the Sustainable Energy Ireland (SEI) website[27].

D Pellets Ltd[28], the first wood pellet production facility to operate in the Republic of Ireland, commenced production in 2008. This facility, located at Knocktopher, Co Kilkenny, has a capacity to produce 75,000 tonnes of wood pellets per annum.

Promoting the use of biomass for energy in Ireland

The policies that drive the development of the biomass sector in Ireland include:

Biomass and the National Development Plan (NDP) [2007-2013]

Over the next seven years, the Irish National Development Plan will invest €184 billion in the Irish economy. The areas in which the NDP will influence the Irish biomass sector include:

- Provision of support for the cultivation of fast-growing species, for the purpose of biomass production.
- The mitigation of climate change.
- Investment in sustainable energy with a view to meeting the target of 15% of electricity produced from renewable sources by 2010.
  - A target has been set to achieve 30% co-firing with biomass in the three peat-fired power stations by 2015.
  - A target has been set for biomass to supply 12% of the renewable heat market by 2020.

Ireland's national climate change strategy (2007 – 2012)[29]

As a signatory to the Kyoto Protocol[30], Ireland is committed to limiting its greenhouse gas (GHG) emissions to 13% above the 1990 level over the period 2008–2012.

The Irish forestry sector has a key role to play in addressing climate change, through carbon sequestration and through the development of renewable energy resources. Forest areas established as a result of grant-aid under the State/European Union (EU) funded afforestation schemes since 1990 are expected to contribute an annual average emission reduction of 2.074 million tonnes of carbon dioxide (CO_2) over the period of the Kyoto protocol (2008-2012).

There is also significant potential for wood fuel to displace fossil fuel, particularly in the generation of heat in industrial, commercial, domestic and institutional markets. In doing so, it will reduce Ireland's GHG[31] emissions.

Irish energy policy – energy white paper[32]

In 2007, a Green Paper on energy policy was published by the Irish government. Following a consultation process, a White Paper on energy policy was introduced in early 2007.

[25] *Source: EUROSTAT Joint Wood Energy Enquiry (JWEE) for Ireland (2008)*

[26] *http://www.sei.ie/uploadedfiles/RenewableEnergy/REIOWoodPelletStoveLeaflet0304.pdf*

[27] *http://www.sei.ie/Grants/GreenerHomes/Wood_Pellet_Fuel_Information/MASTER_COPY_OF_wood_fuel_suppliers.pdf*

[28] *http://www.dpellet.ie/index.html*

[29] *www.environ.ie/en/PublicationsDocuments/FileDownLoad,1861,en.pdf*

[30] *unfccc.int/kyoto_protocol/items/2830.php*

[31] *GHG: Green House Gas*

[32] *www.dcmnr.gov.ie/Energy/Energy+Planning+Division/Energy+White+Paper.htm*

This outlines Irish government energy policy for the period 2007-2020. Its primary objectives are security of supply, environmental sustainability and economic competitiveness. From a forestry perspective, the sustainable energy sub-programme outlines how the renewable energy sector is to be developed.

Sustainable energy sub-programme

At least €276 million will be invested in the Irish sustainable energy sector over the period of the NDP. This is in support of the targets for sustainable energy including the promotion of renewable energy, improved energy efficiency and innovation. Key objectives of the programme include a commitment to deliver significant growth in the use of renewable energy in power generation.

A target of producing 40% of electricity consumption from renewable sources by 2020 has been set[33]. The ESB and Bord na Móna[34] will work with the biomass sector to develop the potential of co-firing (with biomass) at the three State owned peat burning stations[35]. The annual fuel requirements and the expected carbon dioxide emissions from these power stations are shown in Table 5[36] (see case study C for for information on co-firing).

Table 5: Capacity, annual fuel requirements and expected CO_2 emissions from Irish peat-fired power stations.[37]

Site name and location	Gross Capacity Megawatts	Fuel requirements Tonnes milled peat/annum	Emissions[38] Tonnes CO_2/year
Edenderry Power[39, 40] Ballykilleen, Edenderry, Co Offaly	128	1,000,000	904,604
Lough Ree Power[41] Lanesborough, Co Longford	100	835,000	755,345
West Offaly Power[42] Shannonbridge, Co Offaly	150	1,245,000	1,126,232
Total	378	3,080,000	2,786,181

Biomass power generation projects will be supported through the Renewable Energy Feed-in Tariff (REFIT) scheme[43]. Under this scheme, the tariff price for biomass generated electricity is set at 7.2 cent per kWh compared to 5.7 cent per kWh for wind-generated electricity (Table 8).

The use of biomass in power generation will also 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. The White Paper targets for biomass CHP output are shown in Table 6.

Table 6: Combined heat and power (CHP) output targets to 2020.

Item	Unit	2010	2020
Target for biomass generated electricity	MW	400	800
Target for biomass generated heat	%	5	12

Bioenergy action plan for Ireland[44]

The Irish National Bioenergy Action Plan aims to increase the use of renewable energy in three key sectors, namely transport, heat generation and electricity. By 2020, 40% of the electricity consumed in Ireland should be generated from renewable sources. By 2015, all peat-fired power generation stations will be co-fired with 30% biomass. This will reduce Irish carbon dioxide (CO_2) emissions by 900,000 tonnes per annum (Table 5).

To encourage the development of biomass generated electricity, the tariff price for biomass generated electricity is set at 7.2 cent per kilowatt hour (kWh) compared to 5.7 cent per kWh for wind generated electricity. From a forestry perspective, key elements of this plan include the introduction of additional 'top up' payments of €80 per ha for energy crops. This is in addition to the EU energy crops premium payment of €45 per ha[45]. The additional payment of €80 will apply for three years. Other elements of the Irish

33 *Irish carbon budget 2008*

34 *Bord na Móna supply milled peat to four thermal power plants, owned by the Electricity Supply Board and by Edenderry Power Ltd., for the generation of electricity; www.bnm.ie*

35 *Edenderry Power, Lough Ree Power and West Offaly Power*

36 *Submission from Bord na Móna on Ireland's Draft National Allocation Plan (2008 – 2012) www.epa.ie/downloads/pubs/air/etu/nap2submissions/epa_nap2_submission_bord_na_mona.pdf*

37 *Source: Environmental Protection Agency (EPA) www.epa.ie*

38 *Based on 0.5% of input carbon remaining unburned and being disposed of in the ash.*

39 *www.edenderrypower.ie*

40 *Since October 2007, Edenderry Power has been operated by Bord na Móna*

41 *www.esb.ie/main/downloads/news_events/lough_ree.pdf*

42 *www.esb.ie/main/downloads/about_esb/west_offaly.pdf*

43 *www.irbea.org/index.php?option=com_content&task=view&id=178&Itemid=44*

44 *www.dcmnr.gov.ie/NR/rdonlyres/4FFF6234-26CA-46B5-78AA04A7288DA4/0/FinalBioenergyReport.pdf*

45 *ec.europa.eu/agriculture/capreform/infosheets/energy_en.pdf*

bioenergy action plan include:

- The introduction of a bioenergy scheme to encourage farmers to plant new energy crops such as miscanthus and willow.
- A Research Stimulus Fund Programme[46,47] that will fund research into biofuels and energy crops.
- The introduction of a grant scheme for wood biomass harvesting machinery[48] to include wood chippers and forest residue bundlers.
- The encouragement of a rate of afforestation that is sufficient to meet increased market demand for wood fibre in the medium to long term.
- The development of an efficient wood energy supply chain to facilitate the delivery of quality wood fuel at competitive prices.

Promoting wood energy in Ireland

In 2007, the Irish government introduced a five year capital programme to underpin the growth of the renewable heat sector. The grant schemes for this programme have been developed in conjunction with Sustainable Energy Ireland (SEI). The total funding package for this programme is €89 million. The grant schemes contained within this programme are:

Greener Homes Scheme (GHS)[49]

This grant scheme was established in 2007. It allows householders to obtain grants for the installation of renewable heat technologies including wood pellet stoves, boilers, solar panels and geothermal heat pumps. Up to February 2009, 26,352 applications had been approved under the GHS, the uptake of which is shown in Table 7.

ReHeat programme[51]

This grant support scheme enables community groups, commercial sector, public sector 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 December 2008, 124 biomass projects had been completed under this scheme with a total output of 48.42 megawatts. The average biomass boiler installed under this scheme had a heat output of 390 kW[52].

Combined Heat and Power (CHP) grant scheme[53]

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 SEI Biomass CHP/AD[54] scheme has an indicative budget of €5-8 million. This provides grant support to assist the deployment of biomass CHP systems.

This 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, no biomass CHP projects have been commissioned under this scheme. However, a number are in the early stages of development.

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. This is being promoted by State

Table 7: Uptake of the GHS to February 2009.[50]

GHS scheme type	Uptake of GHS to 2/09 No. of schemes as a % of total
Solar	54
Heat pump	23
Biomass	23

46 *www.client.teagasc.ie/louth/docs/minister_wallace_urges_farmers_to_grasp_bioenergy.pdf*

47 *www.coford.ie/iopen24/pub/pub/vol7no8august07.doc*

48 *www.agriculture.gov.ie/forestry/woodbiomasscheme/biomassscheme.pdf*

49 *www.sei.ie/greenerhomes/*

50 *Source: SEI*

51 *www.sei.ie/reheat/*

52 *http://www.sei.ie/Grants/Renewable_Heat_Deployment_Programme/List%20of%20Organisations%20supported%20by%20ReHeat%20programme%20Oct08.pdf*

53 *www.sei.ie/chpgrants/*

54 *AD: Anaerobic digestion*

agencies including COFORD[55], the Forest Service[56], Sustainable Energy Ireland (SEI)[57] and Teagasc[58].

Support schemes – REFIT

On 1 May 2007 the Minister for Communications, Marine and Natural Resources announced the official launch of the Renewable Energy Feed In Tariff (REFIT) scheme. The programme provides support to renewable energy projects over a fifteen year period. The new support mechanism is a change from the previous programme in that it is a fixed feed-in tariff mechanism rather than a competitive tendering process. Applicants in REFIT must have planning permission and a grid connection offer for their projects and they will then be able to contract with any licensed electricity supplier up to the notified fixed prices. The programme provides support of €119m for renewable energy projects over a fifteen year programme[59]. Levels of REFIT support are shown in Table 8.

Table 8: REFIT scheme support levels.[60]

Scheme	Tariff cent/kWh	Date announced
Wind < 5 MW	5.9	1/5/2007
Wind > 5 MW	5.7	1/5/2007
Hydro < 5MW	7.2	1/5/2007
Biomass land fill gas (LFG)	7.0	1/5/2007
Other biomass	7.2	1/5/2007
Biomass CHP	12.0	24/1/2008
Anaerobic CHP	12.0	24/1/2008
Offshore wind	14.0	8/2/2008
Wave	22.0	15/1/2008

The REFIT scheme aims to more than double the contribution of renewable sources in Irish electricity market from 5.2% in 2004 to 13.2% by 2010 by increasing the total capacity of renewable energy technologies to 1,450 MW. This additional capacity will require a capital investment in the region of €440 million.

Case studies

Case study A: Go local

A study undertaken by Purser Tarleton Russell Ltd (PTR) found that 'the rise in private sector forest establishment in Co Clare during the 1980s and 1990s is now resulting in the commencement of timber production from these plantations. There will be a steady stream of production of small diameter logs from farmer-owned forests that will critically test market conditions up until c. 2013, at which stage there will be a dramatic increase in production'[61]. This study identified wood energy as a potential new market for forest thinnings, a market which has been further developed by the Clare Wood Energy Project (CCWEP)[62]. CCWEP is a project funded by the Forest Service[63] with the aim of promoting the installation of wood biomass boilers fuelled by wood chip from farm forests in Co Clare. It is managed jointly by Rural Resource Development[64] (the LEADER group in Co Clare) and by Teagasc[65].

Since the project was launched in late 2005, CCWEP has worked with a number of companies and organisations in Co Clare to identify suitable sites/buildings for the installation of medium-sized wood biomass boilers. It has provided ongoing technical support and training for boiler procurement and installation. Significant work on the establishment of a local wood chip supply chain has also been undertaken. Project partners include local forest owners, the Irish Forestry Contractors Association, the Forest Service[66], Limerick Institute of Technology[67], Limerick Clare Energy Agency[68], Sustainable Energy Ireland[69], Renewable Energy Skills[70], Shannon

55 *http://www.woodenergy.ie/iopen24/*

56 *http://agriculture.gov.ie/forestry/woodbiomassscheme/biomassscheme.pdf*

57 *http://www.sei.ie/Renewables/Wood_Energy/*

58 *http://www.teagasc.ie/forestry/wood_energy/*

59 *http://www.irbea.org/index.php?option=com_content&task=view&id=178&Itemid=44*

60 *www.sei.ie/Renewables/Renewable_Energy_Policy/Policy_Support_Mechanisms*

61 *http://www.ccwep.ie/pdf/Forestry_Report.pdf*

62 *http://www.ccwep.ie/default.asp*

63 *www.agriculture.gov.ie/forestservice/forestservicegeneralinformation/abouttheforestservice*

64 *www.rrd.ie*

65 *http://www.teagasc.ie/forestry/wood_energy/ccwep.asp*

66 *http://www.agriculture.gov.ie/forestservice/forestservicegeneralinformation/abouttheforestservice/*

67 *www.lit.ie*

68 *www.lcea.ie*

69 *www.sei.ie*

70 *www.renewableenergy.ie*

Development[71], Coillte[72] and Finsa Forest Products Ltd[73]. The CCWEP study found that wood chip heating systems are particularly suitable for large heat users including hospitals, leisure centres, schools, hotels, retail, industrial and commercial sites. This found that such heat users have the potential to provide a new outlet for the thinnings from farm woodlands.

Since 2005, CCWEP has worked to develop a local wood chip supply chain. A timber harvesting, chipping, storage and fuel delivery infrastructure is now in place to service the local energy market. A new wood fuel market involving a number of fuel suppliers has been developed, which offers customers a real energy choice at a competitive price. As a result, wood chip boilers have been installed in facilities including Olympus GmbH, Cahercalla Community Hospital, Torpey Wood Products and at the headquarters of Clare County Council.

While building their new headquarters in 2006/07, Clare County Council (CCC) investigated the possibility of installing a wood energy heating system. CCWEP provided ongoing assistance in developing project options. By the summer of 2007, the Council had committed to the construction of a wood fuel boiler system to heat their new headquarters. This was built under a 'design and build' contract. Clearpower Ltd[74] was selected as the design and install subcontractor for the wood boiler. The system as installed features a 540 kW biomass boiler, burning wood chip that is stored in an underground fuel silo. This automatically feeds woodchip into the boiler via a fuel transfer auger. The system has a gas boiler as back-up. Following a competitive tender process, the County Council entered into a heat supply agreement with Clare Wood Chip Ltd[75], who are paid in €/kWh for heat provided. This is measured by a heat meter.

Wood chip is produced from forest thinnings. Harvested wood is first transported to a local wood fuel depot. Here, logs are stored outdoors with the cut ends facing south so that the prevailing wind can penetrate and dry the timber stacks. The stacks are also covered with a reinforced, recyclable paper cover to prevent rainfall re-wetting them. Newly harvested logs have a moisture content of 50–55%. These must first be air-dried to a moisture content of 30-35% before being chipped. This drying process takes around nine months, although the time taken can vary depending upon site condition and on climatic conditions. Once the desired moisture content is achieved, logs are chipped using a Musmax fuel wood chipper[76,77]. Prior to delivery to the client by tractor and trailer, wood chips are housed in a dry shed.

Case study B: Northern Ireland

A Northern Ireland hospital estimates that it could save almost £300,000 a year in heating costs after recently switching from oil to wood biomass heating. Imperative Energy Ltd[78] has successfully completed the installation of a 1.65 MW biomass system in the Downshire Hospital, Downpatrick, Co Down, making it the largest biomass solution operating within the public sector in the UK and Ireland. The system includes a 1.65 MW biomass boiler, a service hopper, fuel transfer system and fuel storage silos. It is expected that this installation will use 1,800 tonnes of wood pellets per annum[79]. In doing so, the hospital expects to save around 1.5 million litres of oil per annum.

The hospital is now using its wood pellet boiler to provide the base load requirements[80] on its 18 ha site. This includes providing heating and hot water to its hospital wards and kitchens. Robert Spence, the estate manager at the Downshire Hospital said recently 'we installed our wood pellet boiler just three months ago and we are already noticing a difference in our heating costs'[81]. Moreover, in terms of environmental impact, the newly installed biomass energy system will reduce carbon emissions from the site by almost 1,000 tonnes per annum. The UK Government has set environmental targets for new build and refurbished hospital estate. These include achieving an energy usage of 35-55 GJ/annum/100 m^3 and that carbon emissions be reduced by 15% over the ten year period from March 2000

71 *www.shannon-dev.ie*

72 *www.coillte.ie*

73 *www.finsa.es*

74 *www.clearpower.ie*

75 *http://www.clarewoodchip.com/index.html*

76 *http://www.mus-max.at/en/land-forsttechnik/forsttechnik/index.html*

77 *Powered by a 215 hp tractor, this machine is capable of producing 15 tonnes of wood chip per hour*

78 *www.imperativeenergy.ie*

79 *The pellets used in this system are manufactured in Enniskillen, Co. Fermanagh by Balcas; http://www.brites.eu*

80 *http://www.energyvortex.com/energydictionary/baseload__base_load__baseload_demand.html*

81 *http://www.architectmagazine.com/search-results.asp?keyword=bradford+mckee*

to March 2010[82]. This reduction in carbon emissions is outlined in the impending Carbon Reduction Commitment (CRC) legislation[83].

This project demonstrates how the operators of large public and private buildings, can simply and cost effectively meet the new Carbon Reduction Commitments being imposed from April 2010 while simultaneously bringing affordability and stability to their annual energy costs.

Case study C: Co-firing PCRW with peat, an Edenderry case study[84]

Approximately four million tonnes of milled peat are produced each year in Ireland from over 20,000 ha of peatland[85]. This is used for power station feedstock, for briquette manufacture and for horticulture.

Each year, around 3.08 million tonnes of milled peat are used as a feedstock at three modern peat fuelled power plants (Table 5). These contribute 6% towards Ireland's total primary energy requirement (TPER)[86]. However, this energy use generates 2.8 M tonnes[87] of CO_2 per annum. In 2007, Ireland's total green house gas (GHG) emissions were 69.205 million tonnes of carbon dioxide equivalent (Mt CO_2eq)[88]. Peat burning power plants are responsible for 4.05% of this total. However, research has shown that the co-firing of peat with wood biomass could reduce the amount of GHG emissions produced from peat fueled power stations by up to 30%.

Edenderry Power is a modern efficient peat-burning power station. It uses 1 million tonnes of milled peat per annum to produce a net output of 118 MW of electricity. In doing so, it produces 905,000 tonnes of CO_2. The characteristics of this facilty are outlined in Table 9.

A study undertaken recently by Ken Byrne (UCC) and Sari Lappi (UCD)[89] investigated the possibility of co-firing milled peat with PCRW (post-consumer recovered wood) biomass at Edenderry. A major advantage of co-firing with

Table 9: An overview of energy production at Edenderry Power.[90]

Item	Details
Operator	Edenderry Power
Net electricity production capacity	118 MW
Boiler	Bubbling fluidised bed boiler
Efficiency	38%
Fuel used	Milled peat supplied by Bord na Móna
Average moisture content	55%
Calorific value	7.7 MJ/kg
Fuel consumption	1 million tonnes/year

PCRW is that it has a very low moisture content and therefore a high calorific value compared to peat. The results of this study showed that there are 'no major obstacles to replace part of the peat with wood biomass'. However, 'infrastructural constraints limit this to 20%'. These constraints include a lack of available PCRW and overcoming infrastructure/transport issues. PCRW supply will also be limited by the fact that Edenderry is only licensed to burn 'clean wood'. Therefore, any PCRW supplied must be segregated, and all treated, varnished, painted or glued components have to be removed from the biomass feedstock.

This study examined the potential emission reduction to be gained by co-firing 50,000, 100,000 or 180,000 tonnes of PCRW. This found that the potential emission reduction ranges from 70,000 tonnes to 320,000 tonnes of CO_2 per year. Currently Edenderry Power produces 1.08 kg CO_2 per kWh. The study found that 'a realistic emission reduction of between 8-15% could be achieved by co-firing a maximum of 100,000 tonnes of PCRW per annum'. By co-firing milled peat with recovered wood, the plant's CO_2 emissions could be reduced from 1.08 kg to 0.86 kg CO_2 per kWh. This study also examined the potential new sources of wood biomass in Ireland (Table 10).

Table 10: The potential for energy production by biomass type.[84]

Resource	%
Forest residues	36
PCRW	35
Sawmill residues	15
Energy crops	14

82 *www.setrust.hscni.net/services/Design%20Team%20Presentation%2005.pdf*

83 *www.environment-agency.gov.uk/cy/netregs/legislation/future/97515.aspx*

84 *Greenhouse gas benefits of co-firing biomass with peat for energy in Ireland; Sari Lappi & Kenneth A. Byrne; IEA bio – energy task 38; www.ieabioenergy-task38.org/projects/task38casestudies/ireland-brochure.pdf*

85 *http://www.sei.ie/uploadedfiles/RenewableEnergy/PeatuseforEnergyinIreland.ppt*

86 *Source: SEI*

87 *Source: Environmental Protection Agency (EPA) www.epa.ie*

88 *http://www.epa.ie/downloads/pubs/air/airemissions/GHG_UN_2007_Final_150409.pdf*

89 *http://www.ieabioenergy-task38.org/projects/task38casestudies/ireland-brochure.pdf*

90 *http://www.authorstream.com/Presentation/Justine-37111-Peatuse-Energy-Ireland-Potential-production-biomass-TJ-Lifecycle-combustion-peat-peatuseforenergyinireland-as-Education-ppt-powerpoint/*