SOUTH-EAST REGIONAL AUTHORITY
ÚDARÁS RÉIGIÚNACH AN OIR-DHEISCIRT

South-East Region BIOENERGY IMPLEMENTATION PLAN

2008 – 2013

South-East Region

BIOENERGY IMPLEMENTATION PLAN

2008 – 2013

A South-East Regional Authority initiative in partnership with the local authorities and local energy agencies in the South-East Region, the Environmental Protection Agency, Teagasc and Sustainable Energy Ireland (SEI). The project was part-funded by SEI.

Consultancy services and technical assistance to the project were provided by Fehily Timoney Rambøll, Mill House, Ashtown Gate, Navan Road, Dublin 15.

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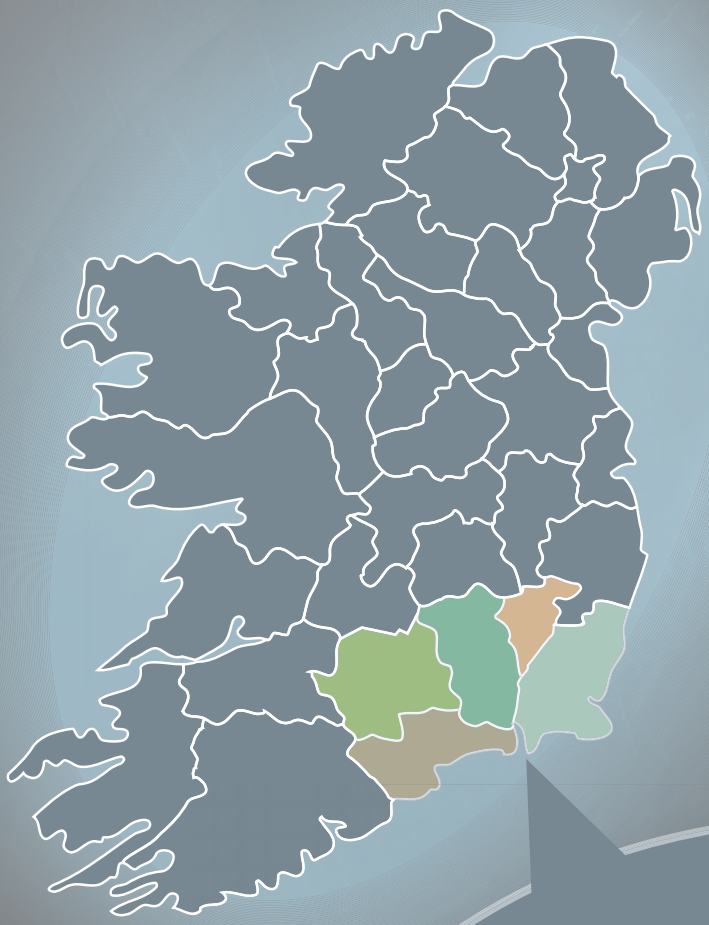


Kilkenny
Carlow
Tullow
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Gorey
Kilkenny
Muine Bheag
South Tipperary
Cashel
Enniscorthy
Thomastown
Wexford
New Ross
Tipperary
Carrick on Suir
Clonmel
Cahir
Wexford
Waterford
Tramore
Dunmore East
Lismore
Dungarvan
Waterford

Foreword

South-East Regional Bioenergy Implementation Plan 2008-2013

SOUTH-EAST REGIONAL AUTHORITY
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FOREWORD

Energy policy has become increasingly important in today's society and ensuring security of sustainable and competitive energy supplies and reducing harmful greenhouse gas emission levels are to the forefront of the political agenda. The location and use of alternative energy sources are paramount to the sustainability of national, regional and local development and competitiveness. Government has stressed the importance of energy policy in view of the crucial role that energy plays in fuelling our growing economy, its key relevance to the management and protection of our environment and our response to climate change.

It is against this background that the South-East Regional Authority, in cooperation with Sustainable Energy Ireland and a wide range of local stakeholders in the Region, embarked upon the development of a Bioenergy Implementation Plan for the South-East Region. Recognising the challenges ahead, the key focus of the Plan is to analyse the scope and potential for bioenergy development in the Region, to identify and reduce barriers to the development of the sector and to harmonise the planning requirements for bioenergy development across the Region. The key objective of the Plan is to make the South-East a leader in the development of bioenergy in Ireland.

The Plan sets out ambitious targets for bioenergy consumption within the Region for 2010 and 2020 to complement the national targets. These targets aim to increase the contribution of bioenergy towards meeting the future total energy requirements of the Region. By achieving the targets set out in the Plan the South-East will become more self-sufficient in securing its energy supply, the Region will reduce its reliance on finite fossil fuels and will benefit from reduced carbon emissions, and in doing so, will create employment opportunities and support regional development. Moreover, the Plan will constitute a framework for the development of bioenergy and a reference document for local and public authorities and private sector interests.

I wish to acknowledge the support and cooperation received by the Regional Authority in this important process from all involved. In particular, I wish to express thanks and appreciation to Sustainable Energy Ireland, Teagasc, the Environmental Protection Agency, the local authorities and the local energy agencies in the Region, the members of the steering committee and to the consultants who provided technical assistance, Fehily Timoney Rambøll. I also wish to thank the Director and staff of the Regional Authority for their work in bringing this project to a successful conclusion.

This Plan is but the beginning of a process and I acknowledge that further work is required in order to ensure that the objectives and actions contained in it are realised. The Regional Authority is committed to coordinating the implementation of the Plan in association with all the key stakeholders in the Region and I look forward to working with all of these in a spirit of cooperation and partnership for the future development of bioenergy in the South-East.

Cllr. Paddy O'Callaghan
Cathaoirleach

October 2007

EXECUTIVE SUMMARY

The South-East Region will become a leader in the development of bioenergy in Ireland. To this end the Region has developed a Bioenergy Implementation Plan with ambitious targets for bioenergy in the heating, electricity and transport sectors in the period to 2020. With the active promotion of the Plan by the South-East Regional Authority and its six constituent local authorities the realisation of the plan will deliver important benefits to the Region.

The implementation of the Plan will significantly increase the production and consumption of energy from biomass in the South-East Region. By achieving the targets set out in the Plan the Region will reduce its reliance on imported finite fossil fuels and will benefit from reduced carbon emissions. With a target of 5% of total energy supply from biomass by 2010, increasing to 17% by 2020, the South-East will become more self-sufficient in its energy supply and will create opportunities to support employment creation and regional development.

The South-East Region's Bioenergy Implementation Plan will also provide a framework for the development of bioenergy in other regions.

The South-East Regional Authority has developed a Bioenergy Implementation Plan for the South-East Region to ensure that the Region takes advantage of the opportunities for the development of the bioenergy sector. The Region has significant potential to develop and expand its bioenergy resources for the generation of heat, electricity and transport biofuels.

The primary aim of the Plan is to promote the sustainable deployment of bioenergy within the South-East Region and to increase the production and consumption of bioenergy within the Region.

The objectives of the Plan are to:

- Increase the contribution of bioenergy to the Region's energy balance
- Reduce the reliance of the Region on imported fossil fuels
- Decrease the carbon footprint of the Region in terms of greenhouse gas (GHG) emissions
- Promote rural development and sustainable agriculture within the Region.

The Plan examines the current situation within the Region with regard to the levels of energy consumption across the sectors of heat, electricity and transport and the current use of biomass for energy generation within the Region. Bioenergy, which denotes renewable energy derived from biomass, landfill gas, biogases and biofuels, currently contributes 1.5% of the total energy consumed within the South-East. This is primarily from the combustion of wood fuels for heat.

This document estimates the bioenergy resources currently available in the South-East Region and identifies the proven technologies that can be employed for energy generation. The selected technologies were analysed with regard to their viability in the South-East Region and were compared with conventional fossil fuel systems. These analyses showed bioenergy production to be an attractive and viable alternative to energy generated by fossil fuel systems under the current economic climate.

Regional targets have been set for the penetration of bioenergy to the three sectors: heat, electricity and transport. The targets for bioenergy deployment in the South-East Region have been set by taking into account the current trends of energy consumption across the Region and the resources available in the Region. The first set of targets is to be achieved by the end of 2010 and the next set is to be achieved by the end of 2020. They have been set for the heat, electricity and transport sectors within the Region.

Current Energy Generation within the South-East Region

The Plan has identified and highlighted the baseline situation within the South-East Region by assessing the current energy consumption and by assessing the bioenergy resources available within the Region. Table 1 outlines the current levels of fuel consumption within the Region and biomass represents 1.5% of this balance. The Plan aims to increase the contribution of bioenergy to the Region's energy needs and has set specific sectoral targets to achieve this.

Table 1: Current Regional Energy Balance

Unit = TJ	Coal	Peat	Oil	N Gas	Renewables	Biomass	Electricity	Total
TFC	1,703	1,282	38,358	6,879	0	872	9,603	58,697
%	2.9	2.2	65.3	11.7	0	1.5	16.4	
CO_2 (Mt)	0.16	0.14	2.81	0.39	0	0	1.70	5.20

Note: TFC:Total Final Energy Consumption

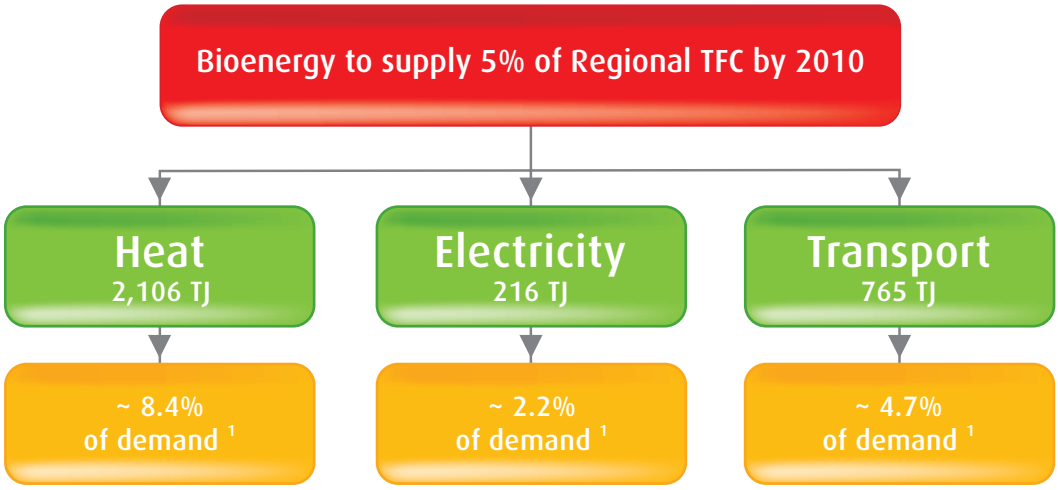
In order to fully comprehend the true bioenergy generating potential of the South-East it was necessary to assess the level of bioenergy resources currently available within the Region. Table 2 presents the estimated current resources within the Region.

Table 2: Summary of Regional Bioenergy Resources

Resource	Potential Energy (TJ)
Forestry Resources Thinnings and logging residues	1,184
Agricultural Resources Solids: i.e. straw Liquids: i.e. slurries	1,104 406
Energy Crops (OSR, SRC willow, miscanthus)	132
Grass as an Energy Crop	321
MSW	738 Note 1
TOTAL	3,885

Note 1: Energy from MSW will not be considered when setting regional targets for the lifetime of this Plan. However, this will be reviewed in 2010 and in 2020, as appropriate.

Regional Targets 2010



[1]It is assumed that energy consumption in 2010 will increase by 5% on 2006 figures

Achieving the 2010 Regional Targets

Heat Sector

In order to achieve the target to increase the contribution of bioenergy to the Region's heat energy needs, the installation of biomass heating systems in the domestic, commercial and industrial sectors will be required across the South-East:

Domestic

The installation of at least 3,000 biomass boilers with a capacity of 20kW each over the next three years will provide a bioenergy heat supply of 486 TJ per annum. This will create a demand for mainly wood pellets.

Commercial/Industrial

The installation of at least 170 boilers with a capacity of 500kW over the next three years will provide a bioenergy heat supply of 1,102 TJ per annum. This will create a demand for wood chip.

Industrial CHP

The installation a 10 MW biomass based CHP-Plant in the Region by end of 2010 will generate a bioenergy heat supply in the order of 518 TJ per annum.

Electricity Sector

A 10MW biomass based CHP-Plant would provide approximately 216 TJ of electricity from bioenergy.

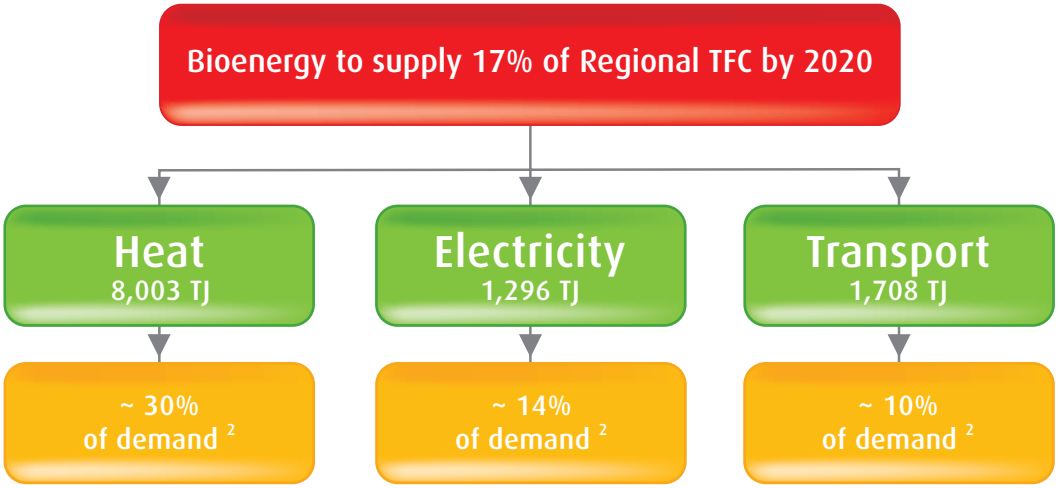
Transport Sector

Green Biofuels Ireland Ltd. is currently constructing a biodiesel plant in New Ross, Co. Wexford and intends to commence production by the end of 2008. This plant will aim to produce 32 million litres of biofuels which is equivalent to 1050 TJ of energy from biomass. Assuming that approx 50% of this biodiesel will be consumed within the Region, this equates to 525 TJ of transport energy from biofuels.

In addition, two pure plant oil (PPO) producing companies based in the South-East – Biogreen Energy Products Ltd. and Goldstar Oils Ltd. – have been awarded Mineral Oil Tax Relief (MOTR) and will produce 14 million litres of PPO by the end of 2010. This is equal to 480 TJ of energy from biofuels and if the assumption is made that half of this PPO will be consumed within the Region, this equates to 240 TJ of transport energy from biomass.

The successful achievement of these regional targets would provide an estimated saving of regional CO_2 emissions of 0.21 million tonnes of CO_2 by 2010.

Regional Targets 2020



[2]It is assumed that energy consumption in 2020 will increase by 10% on 2006 figures

Achieving the 2020 Regional Targets

Heat Sector

In order to achieve the target to increase the production of heat from bioenergy in the Region by 2020, the installation of further biomass heating systems will be required across the South-East:

Domestic

The installation of at least 10,000 biomass boilers with a capacity of 20 kW each over the period from 2010 to 2020 will provide a bioenergy heat supply of 1,620 TJ per annum. This will increase the regional demand for wood pellets.

Commercial/Industrial

The conversion of a further 130 MW to bioenergy heating systems over the period 2010 to 2020 will provide a further bioenergy heat supply of 1,685 TJ per annum. This roughly equates to the installation of a further 260 boilers with a capacity of 500 kW.

Industrial CHP

The installation of a further 50 MW of biomass based CHP-Plants in the Region by the end of 2020 will generate a bioenergy heat supply in the order of 2,592 TJ per annum.

Electricity Sector

The installation of the 50 MW of biomass based CHP would provide 1,080 TJ of electricity from bioenergy.

Transport Sector

The Government has committed to introducing a Biofuels Obligation Scheme which will require fuel distributors to achieve an average of 10% biofuels (on an energy basis) of their total annual fuel business by 2020. This equates to 1,708 TJ of energy for road transport that is to be supplied by biofuels by 2020.

It is expected that this target will be met by a combination of indigenously produced biofuels and a certain level of imports.

The successful achievement of these regional targets would provide an estimated saving of regional CO_2 emissions of 0.91 million tonnes of CO_2 by 2020.

The 2020 targets will be reviewed at the end of 2010 and with regard to progress made and may be adjusted.

Specific Actions to Achieve these Targets

The successful implementation of these regional targets will require a co-ordinated and sustained approach across all sectors in the Region. It will be necessary to achieve a consistent approach to the promotion of bioenergy from all stakeholders within both the private and public sectors. A number of Key Actions will be undertaken within the Region to encourage the supply and demand of bioenergy. These Action Items aim to encourage the sustainable management of the Region's current bioenergy resources and to promote the production of energy crops. They also aim to stimulate the demand for bioenergy across all sectors.

Key Actions	Responsibility	Timeframe
Establish a Steering Committee (SC) to assist with and promote the implementation of the Plan	SERA	End 2007
Launch the South-East Regional Bioenergy Implementation Plan	All SC members	End 2007
Investigate and identify sources of funding and resources for the Plan's implementation	All SC members	Ongoing
Establish key contacts with all the key members of the Ministerial Task Force on Bioenergy	Key SC members	End 2007
Liaise with other Regional Authorities to share experiences on the implementation of Bioenergy Plans or related strategies/plans	SERA	Ongoing

Heat Sector Targets

Key Actions	Responsibility	Timeframe
Publicise the Plan and the Regional Targets to relevant stakeholders	SERA	End 2007
Co-ordinate with SEI to promote the uptake of the Greener Homes Scheme, ReHeat Scheme etc. in the South-East Region	Energy Agencies	Ongoing
Publicise demonstration projects and lessons learned	Energy Agencies	Ongoing
Liaise with the OPW to identify at least one State Building within the Region that could be suitable for conversion to a bioenergy heating system	SERA Energy Agencies	End 2007
Make contact with the Health Service Executive to assess the potential of converting a hospital within the South-East Region to a renewable heating system	SERA Energy Agencies	End 2007
Identify schools in the Region that have the potential to convert to biomass heating. Liaise with the Department of Education and Science	SERA Energy Agencies	End 2007
Investigate the opportunities for district heating in the Region	SERA Energy Agencies	Mid 2008
Promote the uptake of the BioEnergy Scheme to increase the growing of SRC willow for bioenergy purposes in the South-East	Teagasc	Ongoing

Electricity Sector Targets

Key Actions	Responsibility	Timeframe
Publicise the Regional Targets among the commercial, industrial and public sectors	SERA	End 2007
Co-ordinate with SEI to promote the uptake of the new biomass-fired CHP Deployment Programme	Energy Agencies	Ongoing
Promote the use of farm-scale CHP-Plants in the Region	Teagasc	Ongoing

Transport Sector Targets

Key Actions	Responsibility	Timeframe
Publicise the Regional Targets among the public, the local authorities and among the large transport companies in the Region	SERA	End 2007
Promote the use of the energy crop payment amongst the agricultural sector in the Region	Teagasc	Ongoing
Encourage the dissemination of information on the planting, growing, yields and harvesting of oilseed rape	Teagasc	Ongoing
Monitor the development of biodiesel production from oilseed rape within the Region	Energy Agencies	Ongoing
Actively encourage promoters of biodiesel production facilities to participate in regional activities (e.g. annual conference/exhibition)	SERA Energy Agencies	Ongoing
Develop and launch an awareness campaign in relation to the use of biofuel blends in private vehicles	SERA	Mid 2008
Encourage the visible advertising of biofuels at the forecourts	SERA	Ongoing
Liaise with the Local Authorities in the Region with respect to setting targets for fleet conversion to biofuels and consider publicising these conversions as demonstration projects	Energy Agencies	Mid 2008

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ENERGY CONVERSION FACTORS

FROM \ TO	toe	MWh	GJ
toe	Multiply by 1	Multiply by 11.63	Multiply by 41.868
MWh	Multiply by 0.086	Multiply by 1	Multiply by 3.6
GJ	Multiply by 0.02388	Multiply by 0.2778	Multiply by 1

Energy units:

Joule (J):

The international (S.I.) unit of energy.

Kilowatt hour (kWh):

The conventional unit of energy that electricity is measured in and charged for commercially.

Tonne of oil equivalent (toe):

A conventional standardised unit of energy which is defined on the basis of a tonne of oil having a net calorific value of 41,868 kJ/kg.

SI prefixes	
Deca (da) 10^{1}	deci (d) 10^{-1}
Hecto (h) 10^{2}	centi (c) 10^{-2}
Kilo (k) 10^{3}	milli (m) 10^{-3}
Mega (m) 10^{6}	micro (μ) 10^{-6}
Giga (g) 10^{9}	nano (n) 10^{-9}
Tera (t) 10^{12}	pico (p) 10^{-12}
Peta (p) 10^{15}	femto (f) 10^{-15}
Exa (e) 10^{18}	atto (a) 10^{-18}

EMISSION FACTORS

Liquid Fuels	tCO_2/TJ
Motor Spirit (Gasoline)	70.0
Jet Kerosene	71.4
Other Kerosene	71.4
Gas/Diesel Oil	73.3
Residual Oil	76.0
LPG	63.7
Naphta	73.3
Petroleum Coke	100.8
Solid Fuels & Derivatives	
Coal	94.6
Milled Peat	116.7
Sod Peat	104.0
Peat Briquettes	98.9
Gas	
Natural gas	56.8
Electricity	
(2005)	176.8

Note: tCO_2: tonnes of carbon dioxide

GLOSSARY OF TERMS

AD	Anaerobic Digestion
AER	Alternative Energy Requirement
CAP	Common Agricultural Policy
CDP	County Development Plan
CER	Commission for Energy Regulation
CH_4	Methane
CHP	Combined Heat and Power
CIE	Córas Iompair Éireann
CKEA	Carlow-Kilkenny Energy Agency
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COFORD	National Council for Forestry Research and Development
CSO	Central Statistics Office
DAFF	Department of Agriculture, Fisheries and Food
DCENR	Department of Communications, Energy and Natural Resources
DCMNR	Department of Communications, Marine and Natural Resources
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
ESCO	Energy Supply Company
ESP	Electrostatic Precipitator
ETBE	Ethyl-tertiary-butyl-ether
EU	European Union
FÁS	Foras Áiseanna Saothair, the National Training & Employment Authority
FEDARANE	European Federation of Regional Energy and Environmental Agencies
FEPS	Forest Environment Protection Scheme
FFV	Flexible Fuel Vehicle
GHG	Greenhouse Gas
GJ	Giga-Joule (units of energy)
GW	Gigawatt
Ha	Hectare
H_2S	Hydrogen Sulphide
HSE	Health Service Executive
IPPC	Integrated Pollution Prevention and Control
IT	Institute of Technology
JOULE	International System of Measurement for Unit of Energy
KOH	Kalium Hydroxide
kW	Kilowatt
kWh	Kilowatt Hour
LA	Local Authority
LEA	Local Energy Agency

LFG	Landfill Gas
LPG	Liquid Petroleum Gas
MJ	Mega-Joule (units of energy)
MOT	Mineral Oil Tax
MOTR	Mineral Oil Tax Relief
MSW	Municipal Solid Waste
Mt	Million Tonnes
MW	Megawatt
MWh	Megawatt Hour
NBIBC	National Bioenergy and Industrial Biotechnology Centre
NCCS	National Climate Change Strategy
NUI	National University of Ireland
O&M	Operation and Maintenance
OPW	Office of Public Works
OSR	Oilseed Rape
ppm	Parts Per Million
PPO	Pure Plant Oil
PPP	Public Private Partnership
PSC	Project Steering Committee
PSO	Public Service Obligation
RD&D	Research, Development and Demonstration
REFIT	Renewable Energy Feed-in Tariff
ReHeat	Renewable Heat Deployment Programme
RME	Rape Methyl Ester (a form of biodiesel)
RPG	Regional Planning Guidelines
RUE	Rational Use of Energy
RVO	Recovered Vegetable Oil
SC	Steering Committee
SEI	Sustainable Energy Ireland
SERA	South-East Regional Authority
SI	Statutory Instrument
SPB	Simple Pay Back
SRC	Short Rotation Coppice
TCO	Tonnes Carbon Dioxide
TDS	Tonnes of Dry Solids
TEA	Tipperary Energy Agency
TFC	Total Final (Energy) Consumption
TJ	Terra-Joule (units of energy)
TOE	Tonne of Oil Equivalent
TPER	Total Primary Energy Requirement
VAT	Value Added Tax
VRT	Vehicle Registration Tax
WEB	Waterford Energy Bureau
WEMAL	Wexford Energy Management Agency Ltd.
WORD	Wexford Organisation for Rural Development (LEADER Company)

Section One

Introduction to the Bioenergy Implementation Plan for the South-East Region

SOUTH-EAST REGIONAL AUTHORITY
ÚDARÁS RÉIGIÚNACH AN OIR-DHEISCIRT

1. INTRODUCTION

Energy security and availability is one of the most important issues of the 21st century, as the supplies of fossil fuels such as oil and natural gas become constrained. Furthermore, climate change has been acknowledged as one of the most important threats facing future generations and increasing CO_2 emissions from the combustion of fossil fuels has to have been identified as a key cause. In light of these issues, Governments have begun to take steps to encourage the production and utilisation of alternative and renewable energy sources.

In the past decade both the EU and Ireland have become more energy aware. The Irish government recognises that it is essential for Ireland to reduce its almost total dependence on imported fossil fuels and to increase the contribution of renewable energy sources to the national energy requirement. Ambitious targets for the penetration of renewable energy into the energy market have been set, including specific targets for the contribution of bioenergy to the heat, electricity and transport sectors. The planned level of deployment of renewable energy, including bioenergy, will help to ensure that Irish energy supply in the future is considerably more diverse, secure and sustainable.

In the past twelve months, the Government has published:

- *White Paper: Delivering a Sustainable Energy Future for Ireland*
- *National Climate Change Strategy 2007-2012*
- *Bioenergy Action Plan for Ireland.*

These key documents have set out the national government's strategy to encourage diversification of energy supply and the increased deployment of renewable energy, including bioenergy.

The sustainable development of Ireland's bioenergy potential and its deployment in the heat, electricity and transport sectors require a fully coordinated approach at national, regional and local level. In the South-East Region, local authorities, state agencies within the Region and the private sector will need to work together if the Region is to contribute proportionally to meeting the national targets.

In light of this challenge, the South-East Regional Authority (SERA) has developed a *Bioenergy Implementation Plan for the South-East Region.*

The development of the Plan was overseen by a multi-disciplinary Steering Committee with representatives from a number of different local, regional and national bodies. These are:

- South-East Regional Authority
- Sustainable Energy Ireland
- Carlow Kilkenny Energy Agency
- Tipperary Energy Agency
- Waterford Energy Bureau
- Wexford Energy Management Agency Ltd.
- Teagasc
- Environmental Protection Agency
- The Planning Authorities.

The South-East Region aims to be a leader amongst the Irish regions in developing a bioenergy implementation plan and, as such, it is important to take cognisance of all legislation and policy relevant to bioenergy development and to look at all the possible markets.

The Vision which SERA has for the Region is as follows:

The South-East Region will become a leader in the development of bioenergy in Ireland. To this end the Region has developed a Bioenergy Implementation Plan with ambitious targets for bioenergy in the heating, electricity and transport sectors in the period to 2020. With the active promotion of the Plan by the South-East Regional Authority and its six constituent local authorities the realisation of the plan will deliver important benefits to the Region.

The implementation of the Plan will significantly increase the production and consumption of energy from biomass in the South-East Region. By achieving the targets set out in the Plan the Region will reduce its reliance on imported finite fossil fuels and will benefit from reduced carbon emissions. With a target of 5% of total energy supply from biomass by 2010, increasing to 17% by 2020, the South-East will become more self-sufficient in its energy supply and will create opportunities to support employment creation and regional development.

The South-East Region's Bioenergy Implementation Plan will also provide a framework for the development of bioenergy in other regions.

1.1. Bioenergy

Bioenergy is the general term used to denote renewable energy derived from biomass, landfill gas, biogas and biofuels. Biomass is the biodegradable fraction of products, waste and residues from agricultural (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste. It also includes crops specifically grown for energy use.

Energy can be divided into three separate market sectors, namely:

- Heat
- Electricity
- Transport.

Bioenergy technologies can be used as a fuel source in each of these three market sectors([3]).

1.2. The South-East Region

The South-East Region consists of the functional areas of Carlow, Kilkenny, South Tipperary, Waterford and Wexford County Councils and Waterford City Council. The Region has an area of 9,406 sq. kms., which is about 13.5% of the area of the state. The population of the South-East is 460,838, which is 10.8% of the national population.

The South-East is a predominantly rural region and it has a significant bioenergy potential in the form of agricultural land, forestry and waste residues from municipal, agricultural and industrial sources. All of these sources can be used to generate energy in the form of heat and electricity for the residential, commercial and industrial sectors or transformed into biofuels for the transport sector. The development of these bioenergy resources will contribute to both regional and national security of energy supply and fuel diversity objectives and will help to decrease CO_2 emissions in the Region and in Ireland.

Increased use of these resources will mean that the South-East Region will be contributing to meeting national renewable energy targets, to complying with climate change mitigation policies, waste policies and assisting in rural development by providing new markets and employment development opportunities for the farming and forestry sectors.

In the Resolution on "Renewable Energy in the EU" in September 2005([1]) the European Parliament noted that "biomass has many advantages over conventional energy sources, as well as over some other renewable energies, in particular, relatively low costs, less dependence on short-term weather changes, promotion of regional economic structures and provision of alternative sources of income for farmers."

In response to the demand for the development of bioenergy sources there has been a significant body of legislation and policy published in the last decade at both a European and national level. These are outlined and discussed in Chapter 3.

The European Commission has actively encouraged the production of national and regional biomass action plans in response to the EU Biomass Action Plan([2]). The Commission has stated that national and regional biomass action plans "can reduce investor uncertainty by assessing the physical and economic availability of biomass of different kinds, including wood and wood residues as well as wastes and agricultural crops, identifying priorities for the types of biomass to be used and how biomass resources can be developed, and indicating the measures that will be taken at national level to promote this. They can also be linked to consumer information campaigns on the benefits of biomass. Regions can usefully do the same thing."

1.3. Drivers for Bioenergy Development in the South-East Region

In addition to the legislative and policy drivers, there are many non-policy drivers for the development of a Bioenergy Implementation Plan in the South-East Region. These are to:

- Decrease dependency in the Region on imported fossil fuels
- Maintain security of energy supply in the Region
- Reduce CO_2 emissions
- Be a leader amongst the Irish regions – the South-East can be used as an example for the development of implementation plans in other Irish and EU regions
- Encourage employment and rural development
- Support local industry
- Encourage local co-operation amongst suppliers of biomass feedstocks, processors, equipment suppliers, retailers and consumers
- Meet the legislative requirements of EU Directives.

The Bioenergy Implementation Plan for the South-East Region is intended to be used as a framework document for all participants in the bioenergy sector – producers and growers of raw materials, suppliers of technology and fuels and all energy consumers. The Plan is structured in four Sections and these are as follows:

Section One

Chapters 1 and 2 of this document outline the aims and objectives of the Implementation Plan and introduce the key participants involved in the development of the Plan.

Chapter 3 outlines the range of policies and legislation that is driving the development of the bioenergy sector and the support schemes and grant systems which are driving the market.

Chapter 4 outlines the methodology by which the Plan was developed.

Section Two

Section Two highlights the current situation with regard to the bioenergy sector in the South-East Region.

Chapter 5 contains the current estimated energy balance for the Region, detailing the relevant fuel consumption across the sectors of industry, transport, residential, commercial and public services, and agriculture.

Chapter 6 gives details of the resource assessment for the Region. In this assessment, the various bioenergy resources in the South-East were analysed and assessed on the basis of their potential availability and energy content.

Chapters 7 and 8 analyse the range of proven bioenergy technologies applicable to the Region that can be utilised for the production of heat, electricity and biofuels for transport.

Section Three

Section Three of this document investigates the viability of bioenergy as an alternative energy source in the Region and the barriers that can potentially impede development of the bioenergy sector.

In Chapter 9 a number of viability analyses are outlined which investigate the financial viability of bioenergy systems for the production of heat, electricity and biofuels for transport. These systems are compared to conventional fossil fuel systems. On the basis of these viability analyses, a number of targets for the Region for the use of bioenergy resources have been proposed.

Chapter 10 outlines the various barriers that are facing the development of bioenergy as a viable alternative fuel in the South-East Region. Some of these barriers are common across all sectors and some are specific to the three sectors – heat, electricity and transport.

Chapter 11 sets out the regulatory framework to be considered for potential bioenergy developments within the Region.

Section Four

Section Four outlines the Way Forward for the successful implementation of the Plan in the Region and outlines the regional targets for 2010 and for 2020. These targets were set with regard to the current energy consumption in the South-East and the bioenergy resources available.

2. KEY PARTICIPANTS IN THE PREPARATION OF THE BIOENERGY PLAN

The South-East Regional Authority established a Project Steering Committee (PSC) to provide advice and guidance on the development of the Bioenergy Implementation Plan for the Region and invited representatives from a number of regional and national agencies to participate in the PSC. The bodies that were represented on the PSC are presented in this Chapter.

2.1. South-East Regional Authority

The South-East Regional Authority (SERA) is one of the eight regional authorities established in Ireland with effect from 1st January 1994. The South-East Region covers five counties and six local authority areas in the South-East of Ireland - Carlow, Kilkenny, South Tipperary, Waterford City, Waterford County, and Wexford. This is an area of 9,406 square kilometres with a population of 460,838, approximately 11% of Ireland's population. Membership of SERA comprises elected public representatives nominated by the six constituent local authorities within the Region.

The principal functions of SERA include:

- The promotion of co-ordination in the provision of public services in the Region
- The promotion of co-operation between local authorities, public authorities and/or others
- Reviewing the overall development needs of the Region and the making of statements on them as appropriate, and keeping under review the provision of public services in the Region
- Reviewing the Development Plans of local authorities in the Region and in adjoining regions
- The preparation of Regional Planning Guidelines under the Planning and Development Act, 2000
- Making statements on matters that may be requested by the Minister for the Environment, Heritage and Local Government or a constituent local authority
- The preparation of Regional Economic and Social Strategies covering the development needs and investment priorities of the Region
- The nomination of a person for appointment to the EU Committee of the Regions if requested by the Minister for the Environment, Heritage and Local Government
- The provision of proposals, advice, recommendations or information to Government in relation to applications for EU assistance
- Reviewing and monitoring the implementation of measures for which EU assistance is made available
- Reviewing and monitoring the implementation of the National Development Plan 2007-2013

SERA, since its establishment, has set out to be a strong voice for the Region. It adopts a regional approach and focus on issues and concentrates on identifying and articulating the deficiencies and weaknesses of the Region which inhibit its physical, social and economic development.

The Authority has articulated regional concerns in terms of infrastructure, education, tourism, flooding and other issues to government and to the relevant public authorities. Furthermore, SERA has lobbied at governmental and European level for a more equitable distribution of EU funding so that the South-East receives its fair share. SERA seeks to strengthen the Region's voice through the development of links and partnership with the Region's MEPs, Oireachtas Members, Local Authorities and Social Partners.

2.2. Sustainable Energy Ireland

Sustainable Energy Ireland (SEI) was set up by the government in 2002 as Ireland's national energy authority. Its mission is to promote and assist the development of sustainable energy. This encompasses environmentally and economically sustainable production, supply and use of energy in support of Government policy across all sectors of the economy. Its remit relates mainly to improving energy efficiency, advancing the development and competitive deployment of renewable sources of energy and combined heat and power, and reducing the environmental impact of energy production and use, particularly in respect of greenhouse gas emissions.

One of the major functions of SEI is to implement significant aspects of the Green Paper on Sustainable Energy and the National Climate Change Strategy as provided for in the National Development Plan.

SEI is also responsible for:

- Advising the Government on policies and measures on sustainable energy
- Implementing the programmes agreed by Government
- Stimulating sustainable energy policies and actions by public bodies, the business sector, local communities and individual consumers.

SEI Programmes

Sustainable Energy Ireland manages programmes aimed at:

- Assisting deployment of superior energy technologies in each sector as required
- Raising awareness and providing information, advice and publicity on best practice
- Stimulating research, development and demonstration (RD&D)
- Stimulating preparation of necessary standards and codes
- Publishing statistics and projections on sustainable energy and achievement of targets.

2.3. Association of Irish Energy Agencies

The Association of Irish Energy Agencies was established in November 1998 to represent the interests of its members in both the North and South of Ireland. The Association currently consists of 15 agencies that were set up with support from the European Commission under the Rational Urban Energy Planning Programme, a SAVE II Programme.

All energy agencies are established through the local authority framework. The overall aim of the Association is to promote renewable energy and rational use of energy (RUE), to improve the quality of the environment and to contribute to sustainable development. In this way the Association promotes environmental awareness and contributes positively to the protection of the environment.

There are four energy agencies within the South-East Region and representatives from each of the agencies were represented on the Steering Committee for the development of the Regional Bioenergy Implementation Plan.

2.4. Tipperary Energy Agency

The Tipperary Energy Agency (TEA) was established in 1998 as a partnership between North and South Tipperary County Councils and the Tipperary Institute. The Agency's aim is to support the development of sustainable energy in Co. Tipperary and beyond. TEA works in the fields of energy efficiency, energy management, renewable energy and sustainable transport. The Agency is linked to a network of other energy agencies in Ireland and Europe. It is a founding member of the Association of Irish Energy Agencies and is the only Irish member of FEDARENE (the European Federation of Regional Energy and Environment Agencies).

The TEA has completed, and is currently involved in, a wide range of projects. These projects vary from feasibility studies, analysis, resource assessments, product evaluation, demonstration etc. They cover the fields of energy management, energy efficiency and renewable energy.

2.5. Carlow Kilkenny Energy Agency

The Carlow Kilkenny Energy Agency (CKEA) was established to provide sustainable energy information and services to the people of Carlow and Kilkenny, to local businesses and community groups and to the two local authorities.

The mission of CKEA is to contribute effectively to sustainable development in Co. Carlow and Co. Kilkenny by providing sustainable energy information, support and services.

CKEA develops energy awareness and dissemination campaigns. It provides information regarding forms of renewable energy and energy efficient products, local developers, suppliers and installers and the Agency also works with schools on the GreenSchools initiative. CKEA is also involved in energy management for the Councils which involves

the negotiation of energy supply contracts, the management of electricity accounts and the optimisation of Council operations for energy efficiency.

The Agency is involved in a number of energy efficiency and renewable energy projects and provides sustainable energy training for County Council staff and the public. CKEA is a key body in energy policy development, working with Carlow and Kilkenny County Councils to develop specific energy efficiency and renewable energy policies in county and local development plans and public building initiatives.

2.6. Waterford Energy Bureau

The Waterford Energy Bureau (WEB) is a non-profit making bureau facilitating the individual and communities in Waterford County and City in becoming more energy aware and energy efficient. The bureau activities target sustainable energy issues and projects important to Waterford City and County.

WEB is the local Energy Agency for Waterford City and County. The Agency provides a range of energy management, energy conservation and renewable energy services to the public, to business and to the local authorities.

WEB undertakes various programmes for Waterford City and County Councils with regard to energy issues and it advises both local authorities on energy procurement, efficiency and renewable energy technologies. The Bureau promotes an integrated approach to energy management and promotion of the efficient and rational use of energy. WEB also provides an impartial energy information and assessment service to the general public in Waterford.

2.7. Wexford Energy Management Agency Ltd.

The Wexford Energy Management Agency Ltd. was established in August 2001 as a joint initiative of Wexford County Council and the Wexford Organisation for Rural Development (WORD) with support from the European Union under the SAVE II Programme. The Agency is a member of the AIEA and contributes effectively to sustainable development in Co. Wexford by promoting and developing the rational use of energy (RUE) and the use of renewable energy through information dissemination, education, service provision and project development and management.

WEMAL undertakes various programmes for Wexford County Council with regard to energy issues and advises on energy procurement, efficiency and renewable energy technologies. The Agency offers independent advice and information to the general public on energy efficiency and renewable energy initiatives.

2.8. Department of Communications, Energy and Natural Resources

Department of Communications, Energy and Natural Resources
Roinn Cumarsáide, Fuinnimh agus Acmhainní Nádúrtha

The Department of Communications, Energy and Natural Resources (DCENR) is the Government Department with responsibility for the telecommunications and broadcasting sectors and regulates, protects and develops the Natural Resources of Ireland.

The key objectives of the DCENR in the energy sector are:

- To develop a competitive energy supply industry
- To ensure security and reliability of energy supply
- To develop energy conservation and end-use efficiency.

2.9. Environmental Protection Agency

epa
Environmental Protection Agency

The Environmental Protection Agency (EPA) is an independent public body established under the Environmental Protection Agency Act, 1992 and is directly responsible for a wide range of functions, including the regulation of large or complex activities that have significant polluting potential; for monitoring and reporting on environmental quality; and enforcing compliance with environmental protection legislation in Ireland.

The mission of the EPA is to protect and improve the natural environment for present and future generations, taking into account the environmental, social and economic principles of sustainable development. The headquarters of the EPA is within the South-East Region at Johnstown Castle, Co. Wexford.

2.10. Teagasc – Irish Agriculture and Food Development Authority

teagasc
Agriculture and Food Development Authority

Teagasc is a semi-state organisation established under legislation enacted by the Irish Government. The 11 member Board is appointed by the Minister for Agriculture, Fisheries and Food and has representatives from the farming organisations, the food industry, the universities, the Department of Agriculture, Fisheries and Food and Teagasc staff.

Teagasc provides integrated research, advisory and training services for the agriculture and food industry in Ireland. It is a client-based organisation that operates in partnership with all sectors of the agriculture and food industry and with rural development agencies. Around 75% of Teagasc's annual budget comes from the Irish exchequer and EU funding with the balance generated from earned income. Some 40% of the budget is devoted to research with the remainder split half and half between advisory and training services.

Teagasc Headquarters is located within the South-East Region, at Oak Park in Carlow. Oak Park is also the location of Teagasc biofuels activities.

The current programme aims to:

- Investigate the options for the production of energy from agricultural and forest crops and residues
- Improve the efficiency of production of energy crops such as willow, miscanthus, oil-seed rape and others
- Investigate the disposal of effluents on perennial energy crop sites as a means of enhancing their profitability
- Monitor and work to improve the quality of solid and liquid biofuel products such as biodiesel, pure plant oil, wood chips and biomass pellets.

2.10.1. National Bioenergy and Industrial Biotechnology Centre (NBIBC)

It is proposed to establish a NBIBC with its main operations in Carlow and to establish a research fund to facilitate a virtual centre between all the main research labs in this area nationally. The initiative which is being progressed in the Region represents a collaboration between Teagasc National Crop Research Centre, Carlow and participating laboratories in NUI Galway, NUI Cork, NUI Dublin, Trinity College Dublin, IT Carlow and NUI Maynooth. Teagasc Oak Park is taking a lead role in promoting this initiative.

The NBIBC will carry out research in a range of areas including the transformation of lignocellulose for bioethanol which is the next generation of economic biofuel, the development of novel plants designed specifically for energy purposes, production of other high-value biomolecules and novel enzymatic and microbial engineering.

2.11. The Planning Departments of the Six Local Authorities

The Planning Departments of all six of the principal local authorities within the Region were also represented on the Steering Committee for the development of the South-East Regional Bioenergy Implementation Plan.

The planning authorities aim to ensure that the policies of the Plan are consistent with the principles of sustainable development and will ensure that they are incorporated into the planning policies of each county. This will ensure consistency across the Region in the approach to bioenergy development.

3. REGULATORY FRAMEWORK

Due to the increased awareness of renewable energy technologies and an appreciation of the importance of renewable energy sources in establishing a sustainable energy supply for the future, there has been a significant body of legislation and policy published at an international, EU and national level over the past decade.

On a national scale, Ireland's oil consumption has risen rapidly as a result of economic growth and now ranks third in the EU in terms of oil consumed per capita. In 2004, almost 97% of the national primary energy requirement was supplied by the combustion of non-renewable fuels. The Irish Government has stated that it is committed to taking mitigating measures to achieve greater fuel diversity in heat and electricity generation, reduce the reliance on oil in the transport sector and take action on energy efficiency and demand management.

Figure 3.1, overleaf, outlines the main policy and legislative drivers that have affected the current development of the bioenergy sector in Ireland. It should be noted that currently there is no EU Directive outlining targets for the deployment of bioenergy in the heat sector. However, the Irish Government has established national targets.

3.1. International Policy

3.1.1. Kyoto Protocol

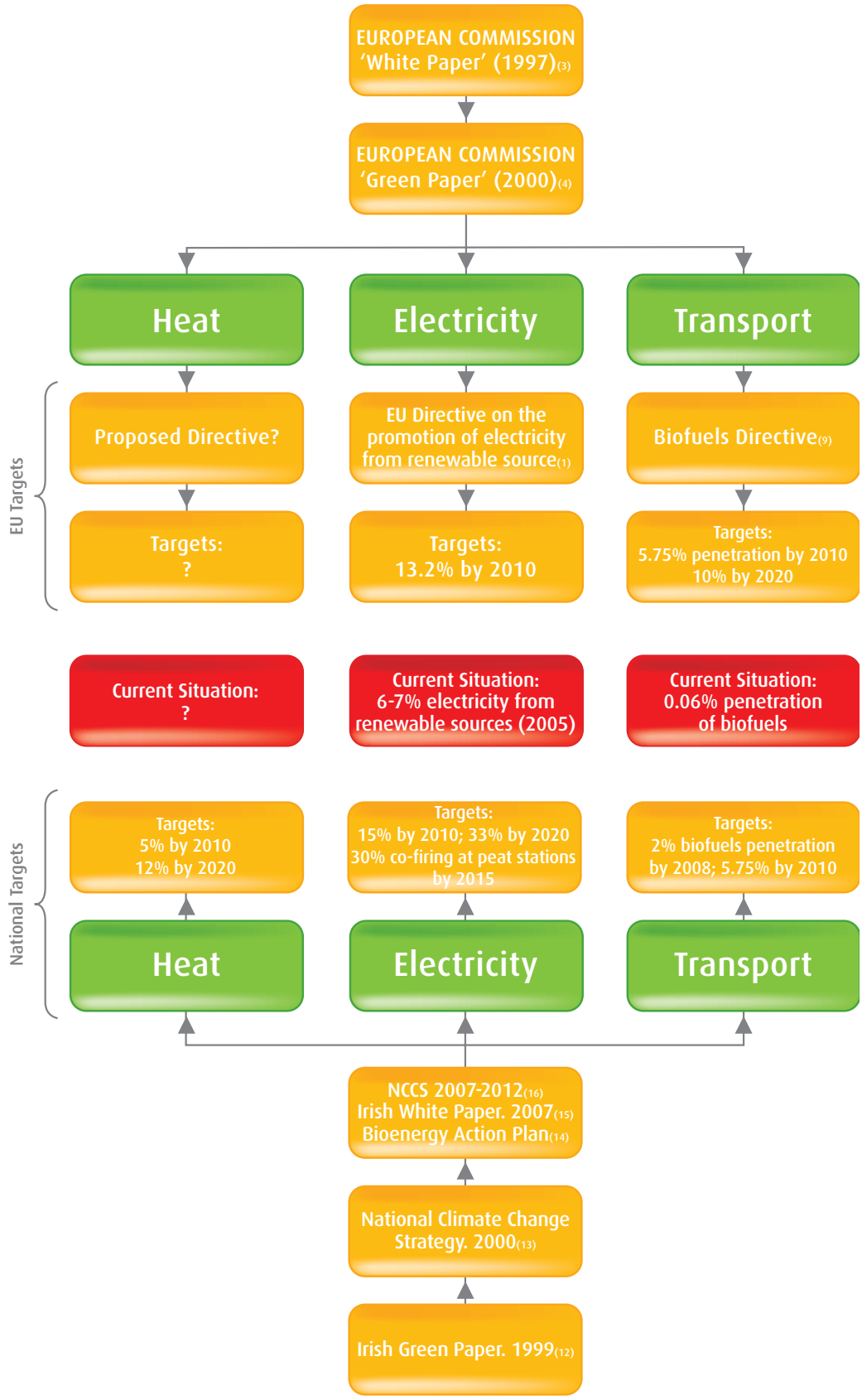
The Kyoto Protocol is an international treaty, the signatories to which are internationally bound to meet the agreed greenhouse gas emission reduction targets. The EU produces around 22% of global greenhouse gas emissions and has agreed to a cut, on average, by 8% from 1990 emission levels. Under the Kyoto Protocol Ireland agreed to a target of limiting its greenhouse gas emissions to 13% above 1990 levels by the first commitment period 2008-2012 as part of its contribution to the overall EU target.

3.2. EU Legislation & Policy

3.2.1. Energy for the Future, Renewable Sources of Energy - White Paper for a Community Strategy and Action Plan ([3])

Published in December 1997, the overall objective of the White Paper was to increase the share of renewable energy production to 12% of total energy use by 2010 throughout the EU.

Figure 3.1: Summary of Bioenergy Policy, Legislation & Targets



3.2.2. European Commission's Green Paper: "Towards a European Strategy for the Security of Energy Supply (2000)([4])

The Green Paper was published in November 2000 and it drew attention to the problems of the EU's energy dependency and also to the EU's commitments under the Kyoto Protocol. The Green Paper called for urgent action in the areas of renewable energy and energy efficiency. It stated that the development of new and renewable energies (including biofuels) is the "key to change" and set a target of doubling their share in the energy supply quota from 6% to 12% and raising their part in electricity production from 14% to 22% by 2010.

3.2.3. EU Directive on the Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market (2001/77/EC)([5])

The Directive was adopted on the 27th September 2001. The overall indicative target of the Directive was to increase the share of renewable energy production to 12% of total energy use by 2010 and to increase the share of renewable electricity production to 22% of total electricity consumption by 2010.

Ireland's target is 13.2% of electricity produced from renewable sources by 2010. At present approximately 6-7% of electricity is from renewable sources (Curtis, 2006[6]).

3.2.4. Buildings Directive (2002/91/EC)([7])

The Directive on the energy performance of buildings requires Member States, when calculating the energy performance of buildings, to take into account the positive influence of "heating and electricity systems based on renewable energy sources".

For new buildings larger than 1000m^2, Member States are required to carry out technical, environmental and economic feasibility studies on the use of decentralised energy supply systems based on renewable energy, on Combined Heat and Power (CHP) and on district or block heating or cooling. This also gives Member States considerable leeway to promote biomass. In many Member States, biomass heating is one of the most practical and cost-effective options.

3.2.5. Common Agricultural Policy (CAP) Reform([8])

The 2003 reform of the CAP means that income support for farmers is no longer linked to the crops that are produced. As a result of this reform, European farmers can respond freely to the increasing demand for energy crops. This reform also introduced a special "aid for energy crops" (under which a premium of €45/hectare is available, with a maximum guaranteed area of 1.5 million hectares as the budgetary ceiling, for the production of energy crops) and maintained the possibility of using mandatory "set-aside" land for growing non-food crops (including energy crops).

3.2.6. Biofuels Directive (2003/30/EC)([9])

The Biofuels Directive was agreed by the European Council and Parliament on 8th May 2003. The main objectives of the Directive are to reduce life-cycle emissions of carbon dioxide from transport across Europe and to reduce the EU's future reliance on external energy sources, in particular, oil.

The Directive aims to promote the use of biofuels or other renewable fuels as a substitute for petrol or diesel in the transport sector. It required Member States to set indicative targets for biofuels sales for 2005 and 2010 and to introduce a specific labeling requirement at sales points for biofuel blends in excess of 5%.

The reference values for setting national targets are:

- 2%, calculated on the basis of energy content of all petrol and diesel for transport purposes placed on their markets by 31 December 2005.
- 5.75%, calculated on the basis of energy content of all petrol and diesel for transport purposes placed on their markets by 31 December 2010.

3.2.7. Biomass Action Plan (Dec 2005)([2])

The Biomass Action Plan set out measures to increase the development of biomass energy from wood, wastes and agricultural crops by creating market-based incentives for its use and removing barriers to the development of the market. The Plan suggested that the EU could more than double its use of biomass for energy by 2010 while complying with good agricultural practice, safeguarding sustainable production of biomass and without significantly affecting domestic food production.

The Plan focuses on promoting the use of energy from biomass in the heat, electricity and transport sectors. It sets out a co-ordinated programme for Community action including measures to improve demand for biomass, improve supply, overcome technical barriers and develop research.

3.2.8. An EU Strategy for Biofuels (Feb 2006)([10])

The EU is supporting biofuels with the aim of reducing greenhouse gas emissions, boosting the decarbonisation of transport fuels, diversifying fuel supply sources and developing long-term replacements for fossil oil.

In the Biofuels Strategy the Commission describes the measures that need to be taken to promote the production and use of biofuels, which include stimulating the demand for biofuels, capturing the environmental benefits, developing the production and distribution of the fuels, expanding the feedstock supplies, enhancing trade opportunities, supporting developing countries and supporting research and development.

3.2.9. An Energy Policy for Europe (2007)([11])

In its Energy Policy, published in January 2007, the Commission proposed an EU objective in international negotiations of a 30% reduction in greenhouse gas emissions by 2020 compared to 1990. It committed to achieving, in any event, at least a 20% reduction in greenhouse gas emissions by 2020.

The 30% target is truly ambitious and its achievement will require major efforts by all Member States. The contribution of each Member State to achieving the Union's target will need to take into account different national circumstances and starting points, including the nature of their energy mix. Member States should have the flexibility to promote the renewable energies most suited to their specific potential and priorities.

The way in which Member States will meet their targets should be set out in National Action Plans to be notified to the Commission. These Plans should contain sectoral targets and measures consistent with achieving the agreed overall national targets and set their own specific objectives for electricity, biofuels, heating and cooling.

3.3. National Bioenergy Policy

3.3.1. Green Paper on Sustainable Energy – 1999([12])

The Green Paper (1999) included a decision to support the building of up to 500 MW of renewable energy based electricity plants, primarily wind powered, to be connected to the electricity network by 2005. In 2004, the target was revised upwards to 718 MW.

A significant proportion of this revised target was to be reached through contracts offered under the government's Alternative Energy Requirement (AER) Programme. Under the AER programme competitions were organised in which project developers bid prices at which they were willing to sell electricity from renewable energy powered electricity generating stations to the ESB for 15 years. The lowest priced bids, up to capacity limits announced in the competition, received contracts with the ESB. The ESB was compensated for the net additional costs incurred from a public service obligation (PSO) levy funded by electricity consumers.

Since the programme was launched in 1995, six AER competitions have been held. The technologies supported include wind energy, small-scale hydropower, combined heat and power (CHP), biomass (landfill gas, CHP and anaerobic digestion) and offshore wind. The final AER competitions, AER V and AER VI, are currently in progress and aim to ensure that the current 718 MW target is reached.

3.3.2. National Climate Change Strategy – 2000([13])

To ensure that Ireland reaches its target under the Kyoto Protocol and following a comprehensive public consultation process, the Government published the National Climate Change Strategy in October 2000. The Strategy provided a ten-year policy framework for action to reduce Ireland's greenhouse gas emissions to 13% above the 1990 levels by the first commitment period (2008 - 2012) of the Kyoto Agreement.

3.3.3. The Bioenergy Action Plan for Ireland (2007)([14])

The Bioenergy Action Plan for Ireland, published on 4th March 2007, set out an integrated strategy for the collective delivery of the potential benefits of bioenergy resources across the electricity, transport, heat, agriculture, enterprise and environment sectors. The Action Plan recognised that a sustained multi-agency collaboration is required at national, regional and local level to ensure these targets and objectives are realised.

The main provisions of the Bioenergy Action Plan are:

Heat Sector	Electricity Sector
• 2020 Expand Greener Homes Scheme (additional €20m provided in Budget 2007) • Set target of 5% renewables by 2010 • Set target of 12% renewables for 2020 • Expand commercial Bioheat Scheme to include combination of renewable technologies (additional €4m provided in Budget 2007). Scheme to include voluntary and community sectors	• It suggests a 33% target for renewable electricity by 2020 • Expand REFIT scheme to support co-firing in peat stations and in waste-to-energy projects
Transport Sector	**Agricultural Sector**
• Set biofuel target of 5.75% for road transport by 2010 • Set biofuel target of 10% by 2020 • Biofuel Obligation Scheme by 2009	• Introduce additional payment of €80 per hectare for energy crops • Bioenergy Scheme to provide establishment grants for miscanthus and willow • Wood Biomass harvesting machinery grant for wood chippers and forest residue bundlers • FEPS scheme to facilitate increased levels of afforestation
Environment Sector	
• Amend planning guidelines to facilitate development of micro renewable technologies at domestic level • Examine re-balancing of annual motor tax to incentivise the public towards cars with lower CO_2 emissions • Energy labelling of vehicles • Promote use of 5% biofuel blends in local authority fleets	

3.3.4. White Paper: Delivering a Sustainable Energy Future for Ireland (2007)([15])

The Department of Communications, Energy and Natural Resources published an Energy White Paper entitled "Delivering a Sustainable Energy Future for Ireland" on 12th March 2007. The White Paper describes the actions and targets for the energy policy framework out to 2020, to support economic growth and meet the needs of all consumers. The Paper sets a clear path for meeting Ireland's goals of ensuring safe and secure energy supplies, promoting a sustainable energy future and supporting competitiveness.

The White Paper recognises that bioenergy has significant potential for the heat market, which is supported by a grant package for installing biomass boilers, for electricity generation as a renewable dispatchable fuel source and as biofuel for the transport sector, which is currently supported by an excise relief package. There are a number of different targets for the incorporation of renewable energy into the heat, electricity and transport sectors which will directly stimulate the development of bioenergy and the White Paper has summarised and highlighted these.

3.3.5. National Climate Change Strategy 2007-2012([16])

The Department of the Environment, Heritage and Local Government published the new National Climate Change Strategy for 2007 through to 2012 in April 2007 and it set out the Government's collective effort across all sectors to tackle climate change over the next five years. The measures outlined in the Strategy co-ordinate closely with the other key policy documents such as the Energy White Paper and the Bioenergy Action Plan.

Summary of National Targets

Heat: 5% of fuel used for heat purchases should be from renewables by 2010; 12% by 2020

Electricity: Achievement of renewable penetration as a proportion of electricity consumption: 15% by 2010; 33% by 2020.

30% co-firing in peat stations with biomass by 2015

Transport: 5.75% biofuels penetration by 2010 and 10% by 2020

3.4. Government Incentive Schemes

In order to achieve the ambitious targets for the deployment of renewable energy in the heat, electricity and transport sectors the Government has put in place a number of support schemes to encourage the change to renewable energy sources across all sectors. The Government is committed to providing long term funding for these schemes.

3.4.1. Greener Homes Scheme([17])

Greener Homes Scheme

The Greener Homes Scheme, administered by Sustainable Energy Ireland (SEI) provides assistance to homeowners who intend to purchase a new renewable energy heating system for either new or existing homes.

Under the Scheme, grants are provided to homeowners who invest in new renewable energy based heating systems in the following categories:

- Solar Heating
  - *Solar hot water system and/or*
  - *Solar space heating system*
- Heat Pumps
  - *Horizontal ground collector*
  - *Vertical ground collector*
  - *Water (well) to water*
  - *Air source*
- Wood Chip or Pellet Stoves – with or without integral boiler
- Wood Chip or Pellet Boilers.

By mid-2007 almost 14,000 applications for the Scheme had been received and approximately half of these applicantions were for wood chip/pellet stoves and boilers.

3.4.2. Renewable Heat Deployment Programme (ReHeat)([18])

The Renewable Heat (ReHeat) Deployment Programme was launched in March 2007 and it provides assistance for the installation of renewable heating systems in industrial, commercial, public and community premises in Ireland. The programme is administered by SEI and is an expansion of the previous Bioheat Boiler Deployment Programme which supported woodchip or pellet boilers only.

Under the ReHeat Programme, grants are available for the deployment of qualifying renewable heating systems in the following categories:

- Boilers fuelled by wood chips and/or wood pellets
- Solar thermal systems
- Heat pumps.

Installations can be in the commercial, industrial and public sectors and also includes community organisations and Energy Supply Companies (ESCOs).

The Programme provides capital investment support as follows:

- Up to 40% or €5,000 per technology (whichever is the lesser) for ReHeat feasibility studies, on a limited basis. The total amount of support is capped at €300,000 for all such studies.
- Up to 30% towards the eligible cost of installing automatic boilers designed to consume wood chips and/or wood pellets up to maximum qualifying cost profiles as listed below in Table 3.1 as well as for solar thermal and heat pumps.

Table 3.1: Maximum Capacity Costs for Biomass Boilers

Plant Scale Ranges (kW)	Maximum Capacity Cost (kW)
≤20	1500
> 20 and ≤ 50	650
> 50 and ≤ 250	500
> 250 and ≤ 500	350
> 500 and ≤ 1000	250
> 1000 Note 1	150

Note 1: SEI should be contacted prior to submitting an application for an installation greater than 1000 kW

Table 3.2: Boilers Installed under the ReHeat Programme in the South-East Region (end June 2007)

Applicant	Address	Boiler Size (kW)
Kelly's Resort Hotel	Rosslare, Co. Wexford	350
Brandon House Hotel	New Ross, Co. Wexford	150
Al Uisce Ltd.	Enniscorthy, Co. Wexford	200
Kilkenny College	Castlecomer Rd., Kilkenny	150
Dunbrody Country House Hotel	New Ross, Co. Wexford	150

3.4.3. REFIT

The Renewable Energy Feed-In Tariff (REFIT) scheme was launched in May 2006 to replace the AER programme. REFIT is operated by the DCENR and provides support to renewable energy projects over a 15-year period.

Under REFIT project developers are free to negotiate with any electricity suppliers in the liberalised electricity market, not just with the ESB. Applicants for REFIT must have full planning permissions, any necessary operating licences and a signed grid connection offer for their projects.

The fixed price tariff for biomass projects is 7.2 cent per Kilowatt hour. The Bioenergy Action Plan announced that REFIT support will now be provided for co-firing of biomass in existing or new thermal plants. This will help in achieving the target for 30% co-firing in peat stations by 2015.

3.4.4. CHP Deployment Programme([19])

On 3rd August 2006 an €11m grants programme for combined heat and power to encourage industry and commercial users to generate their own electricity and heat was launched. In heating terms alone, the Biomass element of the CHP programme will displace the equivalent of 36 million litres of heating oil per annum.

3.4.5. Biofuels Mineral Oil Tax Relief Scheme II

In Budget 2006 a five-year biofuels excise relief package was announced, aimed at placing 163m litres of biofuels on the Irish market by 2008. The primary aims of the scheme are to:

- Develop the biofuels market and to increase the amount of biofuels in Irish transport
- Offer an opportunity to develop alternative transport fuel sources and provide the capacity to address the challenges of future fuel supply
- Deliver targeted reductions in CO_2 emissions
- Assist towards compliance with the EU Biofuels Directive on the promotion of the use of biofuels or other renewable fuels for transport.

Applications for Mineral Oil Tax Relief (MOTR) were invited within four distinct categories of biofuels as follows:

- Biofuel blends complying with EU Diesel Standard EN590
- Bioethanol
- Pure plant oil
- Biofuels used in identified captive fleets.

MOTR has been granted on a five-year basis for biofuel blends and for four years for pure plant oil.

The Department of Communications, Energy and Natural Resources received 102 applications under the MOTR Scheme II. There were 11 applications received in the Bioethanol category, 36 in the EN590 category, 18 in the Pure Plant Oil category and 37 in the Captive Fleets Category. A panel comprising officials from the DCENR, SEI and Enterprise Ireland assessed the applications and made recommendations to the Minister for Communications, Energy and Natural Resources.

On 23rd November 2006 the DCENR announced that sixteen biofuels projects were to be granted excise relief under the Scheme. The successful projects are listed in Table 3.3. Three of the successful applicants are operating in the South-East Region: Green Biofuels Ireland Ltd., Biogreen Energy Products Ltd. and Goldstar Oils Ltd.

Table 3.3: Successful Applicants for MOT Relief in the South-East Region (2006-2010)

Category	Company	Volume Awarded for period 2006 - 2010
EN590	Green Biofuels Ireland Ltd. Blackstoops, Enniscorthy, Co. Wexford	32m litres
Pure Plant Oil	Biogreen Energy Products Ltd. The Leap, Adamstown, Co. Wexford	7m litres
Pure Plant Oil	Goldstar Oils Ltd. Oldcourt, Inistioge, Co. Kilkenny	7m litres

When at full capacity in 2008 the Scheme will result in 2% market penetration of biofuels in the transport fuel market. It will result in savings of over 1.2m tonnes of CO_2 emissions over the five years of the programme. In terms of eliminating pollution this is the equivalent of taking around 70,000 cars per year off the roads over the lifetime of the scheme and is one of the more significant measures being taken by Government to reduce CO_2 emissions as part of its Kyoto commitments.

3.4.6. Public and Commercial Sector Programme([20])

Financial support is available on a limited restricted basis to public sector and commercial organisations to stimulate the innovative application of more sustainable design strategies, technologies and services in new and retrofit projects, acting as both an exemplar for good practice and as a demand leader for the services and technologies involved.

Support is available for high quality proposals in the following categories:

- Generic Design Studies – Public and Commercial Sector Organisations:
  The level of support available to successful applicants is 50% of the additional design or feasibility study cost relating to the innovative energy features.
- Model New and Retrofit Building Projects - Public and Commercial Sector Organisations:
  Support of up to 50% of eligible costs is available to either underwrite risk or offset the marginal cost of additional energy saving features. The support limit, save in exceptional circumstances, will be €500,000 per proposal.
- Energy Management Bureau Services – Public Sector Organisations:
  The scheme provides for funding over a three-year period at up to 50% of eligible costs of service provision. The public sector organisation will commit an agreed level of matching funds to ensure the effective operation of the energy management bureau.

3.4.7. The BioEnergy Scheme([21])

The BioEnergy Scheme provides establishment grants to encourage the growing of willow and miscanthus for the production of biomass suitable for use as a renewable source of energy.

In the BioEnergy Scheme, establishment grants are payable:

- On land used to grow willow and miscanthus under the EU Energy Crops Scheme
- On set-aside land used to grow willow and miscanthus for the production of biomass.

Establishment grants are payments to cover part of the costs of establishing willow and miscanthus crops. Eligible costs include those associated with ground preparation, fencing, vegetation control, the purchase of planting stock, planting and first year cutback, and costs associated with other approved operations.

The grant is payable on 50% of the approved costs associated with establishing miscanthus and willow crops for biomass. The cost of establishment is estimated at €2,900 per hectare, giving a maximum payment rate of up to €1,450 per hectare, with the balance to be invested by the applicant. The minimum allowable area per applicant eligible for the establishment grant is 4 hectares and the maximum allowable area is 20 hectares. Applicants must adequately maintain and manage the crop as a biomass crop grown for bioenergy for a minimum of 7 years from the date of approval.

The grant will be paid in two instalments. A maximum of 75% of the grant (1st Instalment Grant) becomes available following the establishment of the crop. A maximum of 25% (2nd Instalment Grant) becomes available one year after payment of the 1st instalment, provided the applicant has adequately maintained and managed the crop, including the first year cut back.

No annual premium payment is made under the BioEnergy Scheme. Under the EU Energy Crops Scheme, the Department pays an EU premium of €45 per hectare per annum to farmers who grow crops for energy purposes. The Department proposes to pay an additional national top-up of €80 per hectare to the existing EU premium of €45 per hectare, bringing the overall premium to €125 per hectare. It is intended that the additional €80 payment will apply for three years and the maximum area per producer over the 3-year period is 37.5 hectares. Willow and miscanthus crops are eligible for the premium of €125 per hectare, subject to an application under the EU Energy Crops Scheme.

The premium of €125 per hectare is not payable on any biofuel crop grown on set-aside land.

4. METHODOLOGY FOR THE DEVELOPMENT OF A REGIONAL STRATEGY

SERA identified the need for a co-ordinated regional approach to the development of the bioenergy sector in the South-East. SERA is aware that there is a need to co-ordinate and link the recent national policies with the action that is taking place at local level. The South-East is ideally placed to benefit from the development of the sector and, additionally, the Region can contribute to achieving national targets and to ensuring the security of future energy supply.

The development of a Regional Bioenergy Implementation Plan commenced with the formation of a Project Steering Committee (PSC) with representatives from the main bodies that are active in the bioenergy sector within the South-East Region. These agencies and bodies are outlined in Chapter 2. The PSC was active in all aspects of the development of the Plan, from the stakeholder consultation phase through to the reviewing of the Plan and its sign-off.

The inception phase of the Project involved a comprehensive desk study and literature review of all relevant legislation, policies, guidance documents and research papers in relation to bioenergy development within Ireland and the South-East Region.

The stakeholder consultation began with the creation of a comprehensive stakeholder database for the Region. This involved gathering the contact details for the majority of the actors within the Region for whom this Plan is relevant. These included farmers, developers, technology providers, sales people, local authority representatives, sustainable development agencies, energy suppliers etc. The stakeholder database for the Region is included in Appendix 1. These stakeholders were invited by SERA to attend at a stakeholder forum in Kilkenny in December 2006. This facilitated workshop, hosted by SERA and the PSC members, presented the stakeholders with the aims and objectives for the Plan and invited their comments and questions in relation to the development of bioenergy within the three sectors – heat, electricity and transport. The companies represented at the workshop are listed in Appendix 1.

The analytical phase of the Project involved the preparation of a regional energy balance, a resource assessment for the Region and a review of existing technologies for the production of bioenergy. The energy balance was compiled by using the national energy balance and using various factors to apportion the energy production and consumption for the South-East. The resource assessment involved compiling data for the energy crops and raw materials within the Region and, by estimating the availability of each resource, producing a figure for the potential energy from biomass within the Region. The energy balance and resource assessment were then used to develop potential Growth Scenarios for the projected development of the South-East's resource and how the proper and sustainable management of this resource can contribute to energy supply.

The final phase of the Bioenergy Implementation Plan process is the development of an Implementation Strategy to ensure the sustained and well-managed development of bioenergy within the Region without resulting in environmental or socio-economic damage. This phase of the Plan involved the identification of actual and potential barriers to successful deployment and suggested mitigation measures, how the local authorities within the Region can contribute to sustainable development of the sector, the statutory requirements in relation to the development of facilities for processing bioenergy raw materials and the assignment of responsibilities for the successful delivery of the Plan.

Section Two

Current Situation within the South-East Region

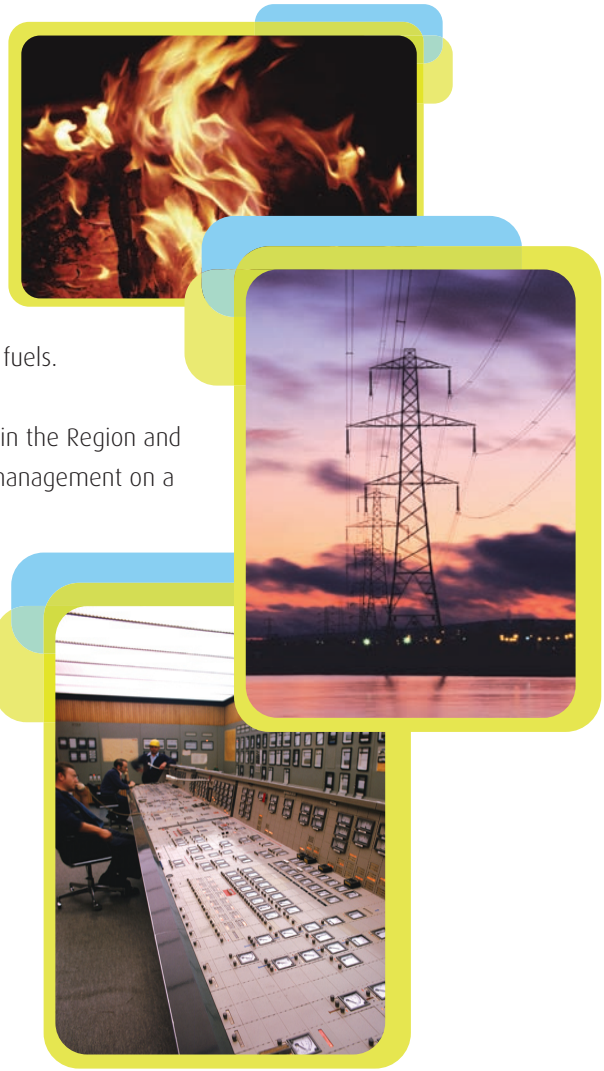
SOUTH-EAST REGIONAL AUTHORITY
ÚDARÁS RÉIGIÚNACH AN OIR-DHEISCIRT

5. CURRENT ENERGY BALANCE

An estimated energy balance was prepared for the purpose of assessing the current energy situation within the Region. The primary aim of this undertaking is to identify the current demand for energy within the Region.

The energy balance provided information on the energy requirements of the following five sectors:

- Industry
- Transport
- Residential
- Commercial/Public Services
- Agriculture.



It also illustrated the levels of consumption of the various forms of fuels. This energy balance identifies the areas in which energy consumption can be supplemented by alternative fuels.

This regional balance can be used to monitor energy usage within the Region and to identify future trends. This will allow more effective energy management on a regional basis. It will also serve as an information tool for investors to identify the key areas for development of renewable energy.

5.1. Energy Balance Method

Sustainable Energy Ireland, on behalf of the DCENR, produces a national energy balance on an annual basis and it gives details of the total primary energy requirement (TPER) and the total final consumption (TFC) for Ireland.([22]) TPER is the total quantity of energy consumed within the country and Available Final Energy Consumption is a measure of the amount of energy that is available once the energy used in the production of useable energy and in non-energy related activities has been deducted.

TFC is a measure of the energy that was actually consumed within the Region. The most recently available national energy balance is for 2006 and this was used as a basis for developing the regional balance for the South-East Region.

The general approach that has been taken is to proportion data found at a national level and to weight it according to the consumption within the various sectors.

The results are presented in Table 5.1.

Table 5.1: Estimated Energy Balance for the South-East Region

Units=TJ	COAL	PEAT	OIL	NAT GAS	RENEWABLES	Biomass	ELECTRICITY	TOTAL	% of total
Total Final Energy Consumption (TFC)	1,703	1,282	38,358	6,879	0	872	9,603	58,697	
Industry Note 2	624	0	3,470	2,950	0	769	3,620	11,433	19.48
Transport Road Transport Note 3	0	0	16,180	0	0	15	0	16,195	27.59
Public Passenger Services, Rail, Domestic Aviation, International Aviation, Fuel, Tourism, Unspecified Note 1	0	0	9,635	0	0	0	36	9,671	16.48
Residential Note 4	988	1,282	5,141	2,853	0	77	3,137	13,478	22.96
Commercial/ Public Services Note 5	91	0	2,096	1,076	0	11	2,455	5,729	9.76
Agricultural Note 6	0	0	1,836	0	0	0	355	2,191	3.73

Note 1 Assumptions based on the fact that 10.87% of the national population resides in the South-East Region
Note 2 Based on 1997 data showing that the South-East contains 11.2% of people employed in the industrial sector
Note 3 11.85% of road vehicles (private cars/motorcycles and goods vehicles) are registered in the South-East Region
Note 4 Based on 2002 data: 10.78% of private households are in the South-East Region
Note 5 Based on 1997 data showing that the South-East contains 8.4% of people employed in the commercial/public sectors
Note 6 16% of agricultural land lies in the South-East Region

5.2. Regional Fuel Consumption

What is immediately apparent from the estimated energy balance is the almost total reliance of the South-East Region on imported energy supplies. Table 5.2 provides a breakdown of the level of fuel consumption in the Region and the estimated regional CO_2 emissions. The vast majority of energy consumption in the Region is supplied by oil (65.3%), with natural gas being the next most popular source of energy (11.7%). Electricity supplies 16.4% of the energy in the Region and the one ESB power plant located within the South-East, at Great Island, Co. Wexford, is an oil-fired plant.

Biomass currently supplies 1.5% of the Region's energy requirements and is consumed solely in the Industrial and Residential sectors for the production of heat.

Table 5.2: Fuel Consumption & Estimated CO_2 Emissions in the South-East Region

Fuel Type	% Consumption in the SE Region	CO_2 Emissions (M tonne)
Coal	2.9	0.19
Peat	2.2	0.13
Oil	65.3	2.82
Natural Gas	11.7	0.33
Renewables	0.0	Note 1
Biomass	1.5	Note 1
Electricity	16.4	1.58
TOTAL		**5.05**

Note 1: For the purpose of this assessment, renewable fuels are assumed to be carbon neutral

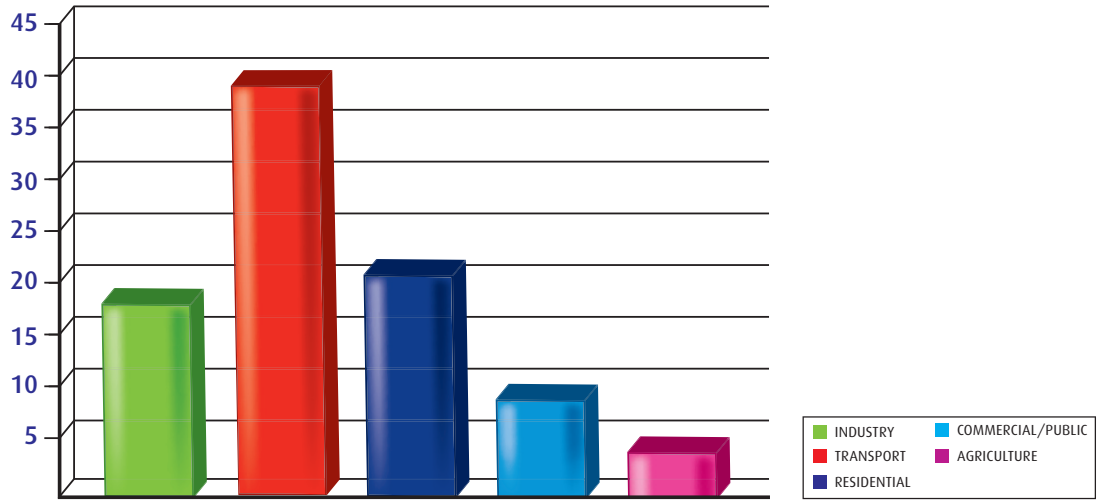
Table 5.3 outlines the current estimated consumption of biomass according to the three energy sectors: heat, electricity and transport. At present, within the Region, biomass is utilised predominantly for the production of energy for heating, primarily in two panel board mills.

Table 5.3: Current Use of Biomass According to Energy Sector

Final Energy Consumption	Biomass Consumption (TJ/Year)	Total Consumption (TJ/Year)	Share of Biomass Consumption (%)
Heating sector	857	23,228	3.7 %
Electricity sector	0	9,603	0.0 %
Transport sector	15	25,866	0.06 %
Total, all sectors	872	58,697	**1.5 %**

Figure 5.1 shows the consumption of energy across the five sectors – industry, transport, residential, agricultural and the commercial/public services. Transport is by far the sector that consumes the most energy and it is responsible for 44% of all energy consumed in the Region.

Figure 5.1: TFC by Sector



5.3. The Residential Sector

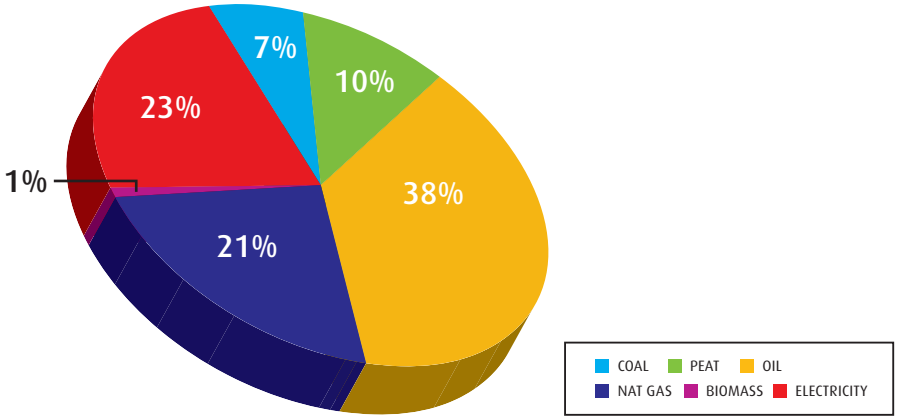
The latest Census, taken in 2006, showed that the population of the South-East Region is currently 460,838 people which constitutes 10.87% of the State's population ([23]). This is an increase of 8.7% on the population recorded in 2002. In the 2002 Census, the urban population was 41.4% of the total for the Region.

According to 2002 Census data, the number of private residences within the South-East was 138,860 ([23]). 10.78% of the private residences in the State are in the South-East Region. The average number of persons per household is 2.95.

The ratio of 10.78 was used in order to weight fuel consumption in the residential sector within the South-East Region. Due to the availability of different fuel types across the Region, there will be variances in the reliance of various fuel types in different areas. For instance, there is no piped supply of natural gas in Co. Wexford but it is available in other areas such as South Tipperary. It is assumed that usage will balance out when considered from a regional level.

The total annual residential energy use for 2005 was estimated as 13,478 TJ which represented almost 23% of the TFC in the South-East. The proportion of energy use per fuel type is shown in Figure 5.2 and it shows that oil is the predominant fuel type, accounting for 38% of all residential energy use.

Figure 5.2 Residential Energy Use per Fuel Type



It is evident that the residential sector is almost totally reliant on imported fossil fuels. Oil and natural gas are the principal fuels for the residential sector. There is one electricity generating station within the South-East Region – the Great Island oil-burning power station in Co. Wexford. Renewable energy only supplies 1% of the energy consumption within the Region and this supply comes predominantly from biomass.

However, the Greener Homes Scheme was introduced by SEI on behalf of the Department of Communications, Energy and Natural Resources in early 2006. This scheme encourages householders to install various forms of domestic renewable energy technologies.

According to information provided by SEI, 1035 grant applications for the Greener Homes Scheme were received from within the South-East Region up to June 2007. This will be reflected in the future energy balance for the residential sector.

5.4. The Transport Sector

The transport sector in the South-East Region is dominated by road transport. The transport sector, as a whole, used an estimated 25,866 TJ in 2005, which represented 44% of the total energy consumption within the Region.

Energy consumption by road transport and by other transport was examined separately. Energy consumption by road transport, incorporating private motor vehicles and goods vehicles, constituted almost 63% of the overall energy use within the transport sector. In all areas of the transport sector, oil was the predominant fuel source. There is no indigenous oil supply within the South-East Region and, thus, the transport sector within the Region is totally reliant on imported fossil fuels.

5.4.1. Road Transport in the South-East

The number of private cars registered in the Region (2005) was 193,098, the number of motorcycles registered was 4,547 and the number of goods vehicles registered was 37,242([24]).

The figures for 2006 had been released at the time of compiling this Plan but details for the regional breakdown of motor registrations had yet to be published. However, on a national scale, the number of private vehicles registered has increased by 7.02%, the number of motorcycles registered has increased by 1.83% and the number of goods vehicles registered has increased by 11.19%. This leads to an estimated total for the South-East Region of 206,653 private cars and 41,409 goods vehicles. This represents 11.85% of road vehicles within the State (private and goods). This was used to weight the TFC in the transport sector in the South-East.

The sector is almost totally reliant on oil as a fuel source. The total annual energy use for road transport alone in 2006 was estimated as 16,195 TJ which represented 27.59% of the TFC in the South-East.

5.4.2. Other Transport in the South-East

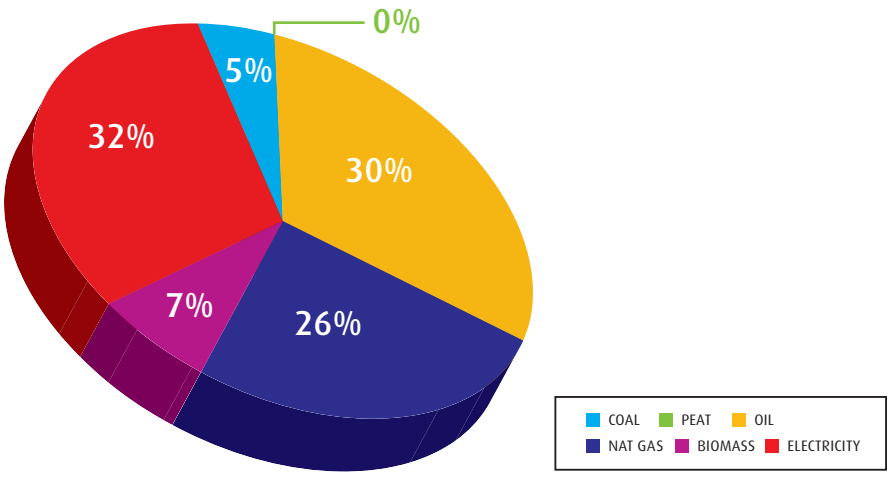
In the national energy balance the other forms of transport include public passenger services, rail, domestic aviation, international aviation and others unspecified. For the purposes of creating an energy balance for the South-East, the weighting for the energy consumption in this sector was taken as the percentage of the population residing in the South-East (10.87%).

Using this methodology, it was found that these other forms of transport had an estimated TFC of 9,671 TJ in 2006, which represented 16.5% of the energy consumption in the Region.

5.5. The Industrial Sector

The most recent survey carried out in 1997 showed that the South-East contained 11.2% of people working in the industrial sector ([25]). This figure was used in order to estimate the TFC within this sector. This equated to 11,433 TJ per annum. As can be seen from the breakdown in Figure 5.3, the industrial sector is predominantly a consumer of oil. The contribution of renewable energy to this sector is negligible.

Figure 5.3 Industrial Energy Use per Fuel Type



The industrial sector in the South-East is responsible for the consumption of 19.5% of the energy within the Region.

A high proportion of manufacturing industry in the South-East Region is foreign owned and is concentrated mainly in electronics and precision engineering, pharmaceuticals and healthcare and in internationally traded services.

The principal large companies in the South-East include:

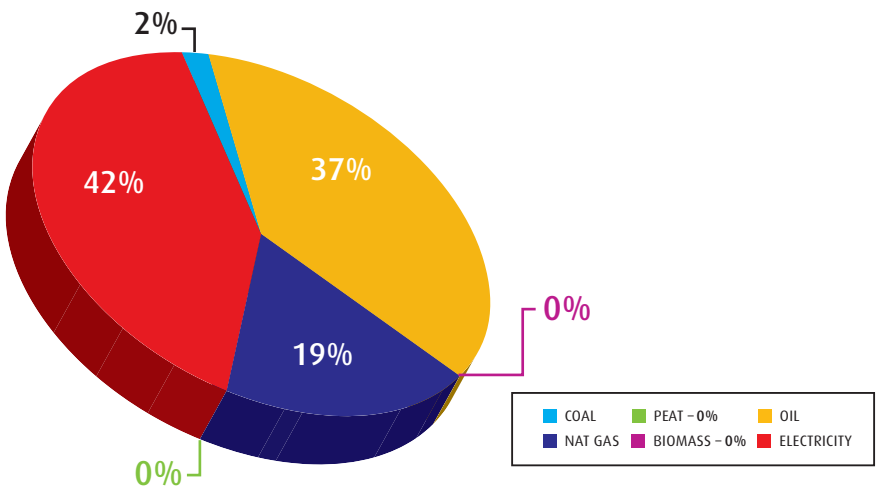
- Braun Ireland Ltd.
- Lapple Ireland Ltd.
- Merck Sharpe & Dohme
- Abbot Laboratories (Ireland)
- Boston Scientific
- Clonmel Healthcare
- AOL Bertlesman
- Bausch & Lomb
- Honeywell International Ltd.
- Smartply Europe Ltd.
- Hasbro Ltd.
- Garrett Engine Boosting Systems
- IVAX
- Glaxo Smithkline
- ABS Pumps
- Equifax Database Company
- Alza Ireland Ltd.
- Lake Region Manufacturing Company
- Sola ADC Lenses
- Weyerhaeuser Europe Ltd.

Two large panel board mills are located in the South-East Region: Smartply Europe Ltd. in Belview, Co. Kilkenny near Waterford City and Weyerhaeuser Europe Ltd. in Clonmel, Co. Tipperary, and both are owned and operated by Coillte. These industries are typically large users of energy for heat.

5.6. Commercial & Public Services

The 1997 data also showed that the proportion of commercial and public sector workers that work within the South-East Region is 8.4%. This figure was used to determine the energy consumption within the commercial and public services, which was 5,729 TJ and which equates to almost 10% of energy consumption for the Region.

Figure 5.4 Commercial/Public Services Energy Use per Fuel Type



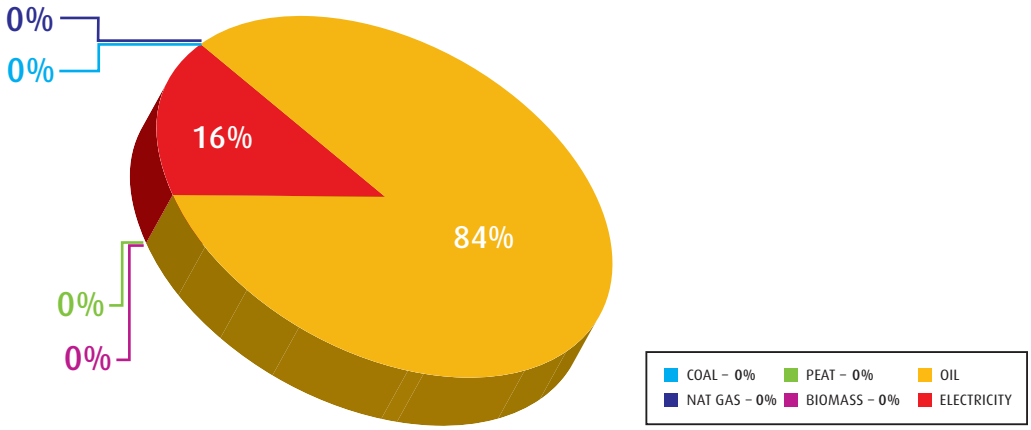
As can be seen from Figure 5.4, this sector is heavily reliant on oil-fired electricity and also directly on oil supplies. Again, the contribution of renewables to the energy supply of the commercial and public services is negligible.

5.7. The Agricultural Sector

The total number of hectares farmed in the South-East Region in 2004 was 689,200 ha, which is 16% of the total area farmed within the State([26]).

Although the agricultural sector is only responsible for 3.7% of the energy consumption within the Region (2,191 TJ), it is clear from Figure 5.5 that the sector is completely reliant on oil and oil-fired electricity.

Figure 5.5 Agricultural Energy Use per Fuel Type



5.8. Energy Requirement & Consumption within the South-East Region

The total estimated energy consumption in the Region for 2006 was 58,697 TJ and this is 11% of the national consumption. This would appear to be a reasonably accurate analysis considering that the South-East Region constitutes 13.5% of the area of the State and is home to 10.87% of the population.

Based on the energy balance prepared it is clear that transport is the primary sector responsible for energy consumption in the Region with an estimated 25,866 TJ being consumed in 2006 (44% of the total).

5.9. Data Sources

Information is mostly available on a national basis with little or no accurate information on a regional or county basis. In order to prepare this energy balance for the South-East Region a number of assumptions were made. Energy balances have been prepared by the Local Energy Agencies for the individual counties within the Region and these were used as a valuable source of data for the regional balance. However, a regional balance was necessary to highlight the overall distribution of energy generation and consumption across the Region as a whole and to identify key sectors that could increase their usage of renewable fuels, in particular the use of bioenergy.

6. BIOENERGY RESOURCES WITHIN THE REGION

This Chapter assesses the potential bioenergy resources that currently exist within the South-East Region and calculates its energy potential. Furthermore, a number of potential scenarios have been explored to assess the ability of the South-East to expand its bioenergy generation capacity. Viability analyses of these resources and their potential for energy production is discussed in Chapter 9 and the barriers to their development are also explored.

6.1. Review of Bioenergy Resources

The bioenergy resources available within the South-East Region are as follows:

Wood

Wood can be processed to wood chips or pellets and used for the production of heat in a low-pressure boiler or for the production of electricity and heat in a combined heat and power (CHP) plant. The wood resource examined for this Resource Assessment comprised an estimation of the volume of first thinnings produced annually in the Region and an estimation of the forestry residues left after logging. These residues comprise the thin tops, branches, dead wood and bent or rotten material.

Willow

Short rotation coppice (SRC) Willow (Salix species) is a fast growing, high yielding variety of tree, planted at a high density (approx. 15,000 trees per hectare). In the first growing season SRC Willow should reach 2-4m in height depending on ground conditions. Following the first year's growth the trees are cut back to ground level to allow stool formation, i.e. multiple stems from each rootstock. The trees are then harvested on a three-year rotation for a period of 15-20 years. The trees do not have to be reestablished after each harvest. The woodchip material produced at each harvest is subsequently dried and used for bioenergy.

Oilseed Rape

Oilseed rape (OSR) is the primary crop for biodiesel production in Europe because of its high oil content of 40%. OSR can be used to produce pure plant oil (PPO) and biodiesel is produced from the oil by a transesterification process. Both PPO and biodiesel can be used as transport biofuels, but this Plan focuses mainly on biodiesel, as it can be blended with conventional diesel oil for use in standard diesel engines. The use of PPO requires an engine conversion and will thus be targeted towards specific markets and fleets.

Animal Slurry

Like other biological waste products, slurry may be used as a raw material for biogas production, using anaerobic digestion (AD) technology. As the content of organic matter in slurry is relatively low, it is beneficial to mix it with other more concentrated organic waste fractions, such as waste from slaughter houses and dairies.

Biogas can be used in all three energy end-use sectors. Biogas for transportation will not be further described, however, as this application requires comprehensive infrastructural investment.

Sugar Beet and Cereals

Sugar beet and cereals are the main raw material used for bioethanol production, but other sugary and starchy materials can also be used. Bioethanol can be used as a blend with conventional petrol and it can also be used in Flexible Fuel Vehicles (FFV) at an 85% blend, as discussed in Chapter 8.

Grass

Grass has the potential to be used as a feedstock in an AD plant to produce biogas. One advantage of grass as an energy crop is that there is a large amount of knowledge and experience in relation to grass production within the agricultural community. Furthermore, there are none of the high start-up costs that are associated with the growing of oilseed rape, miscanthus or short rotation coppice. The anaerobic digestion of grass would also require other feedstocks, of which there is a large supply (e.g. food processing and slaughter house wastes), so there is an added advantage from a waste management point of view.

Miscanthus

Miscanthus is a perennial, rhizomatous grass which typically requires 3 years to establish. The crop is planted in the Spring and once established can remain for at least 15 years. Bamboo-like canes are produced during late Spring and Summer and these are harvested in late Winter. The establishment and harvesting of miscanthus can be done with conventional farm machinery

Miscanthus can be combusted to produce heat and/or electricity on a range of scales from large power stations requiring hundreds of thousands of tonnes of biomass annually to small-scale systems requiring just a few dozen tonnes during Winter months.

Municipal Solid Waste

Municipal solid waste (MSW) can be a source of bioenergy either by combusting it in a thermal treatment facility with energy recovery or by using anaerobic digestion technology to produce biogas which is used for energy generation.

Landfill Gas

Landfill gas, which is produced by the natural degradation of waste, can be used for energy generation if produced in sufficient quantities and with sufficient levels of methane.

6.2. Summary of Regional Bioenergy Resources

Table 6.1 outlines a summary of the potential bioenergy resources in the South-East Region. These resources are discussed individually in the following sections. It should be noted that for each of the resources discussed, there are alternative end uses. For the purpose of this Resource Assessment, an estimation of the availability of each resource for energy has been made. This is by no means conclusive and the availability of any given resource is subject to change. The availability of each resource for bioenergy purposes will ultimately be determined by market forces.

Table 6.1 Summary of Regional Bioenergy Resources

Resource	Potential Energy (TJ)
Forestry Resources Thinnings and logging residues	1,184
Agricultural Resources Solids: i.e. straw Liquids: i.e. slurries	1,104 406
Energy Crops (OSR, SRC willow, miscanthus) Grass as an Energy Crop	132 321
MSW	738[Note 1]
TOTAL	**3,885**

Note 1: Energy from MSW will not be considered when setting regional targets for the lifetime of this Plan. However, this will be reviewed in 2010 and in 2020, as appropriate (see Section 6.7)

6.3. Energy Resource from Forestry in the South-East Region

The South-East Region has a significant energy potential in its wood resource.

The proper management of this resource as an energy source would yield a number of benefits, including:

- Encouragement of rural development and employment in producing wood fuel to meet the increased market demands
- Improvement of indigenous wood supply chains
- Substitution of fossil fuels and consequently a reduction in the emissions of greenhouse gases
- Enhancement of the security of the Region's energy supplies.

Table 6.2: Energy from Forestry

	Land Planted (ha)[Note 2]	Estimated Thinnings (m^3)[Note 3]	Estimated Clearfell (m^3)[Note 4]	Estimated Private Forestry Resource (m^3)[Note 5]	Total Resource (m^3)	Estimated Availability (25%) (m^3)[Note 6]	Energy Resource (TJ) [Note 7]
SE Region [Note1]	90,956	152,440	297,680	76,000	526,120	131,530	1,184

Note 1 52% of resource for Co. Tipperary is assumed to be in South Tipperary (corresponding to the land area split)
Note 2 Source: Dept. of Agriculture 2006 – Forestry Statistics
Note 3 Source: Coillte forecasts for 2010
Note 4 Source: Coillte forecasts for 2010
Note 5 Source: COFORD
Note 6 Assume 25% availability of resource for energy purposes
Note 7 Energy content of 9 GJ per m^3 ([27])

Table 6.2 shows the current planted forestry in the South-East Region and an estimation of the potential of this forestry as an energy resource. This energy can be utilised to generate renewable heat and electricity.

The forestry resource in the South-East Region is currently fully utilised in the added-value forest products industry and the supply/demand balance is, and will continue to be, very tight. However, the demand for wood fuel for bioenergy purposes has been established in the Region and will continue to grow. The future availability of this resource for energy will be determined by the practicality and economics of recovering suitable material and by market forces.

6.4. Energy Resource from Agricultural By-products in the South-East Region

Agriculture is a vitally important industry within the South-East Region and 16% of the State's agricultural land is contained within the Region (CSO data, 2004). In recent times, the Government has placed much emphasis on the role that agriculture can play in energy production. The 2003 reform of the CAP means that income support for farmers is no longer linked to the crops that are produced. As a result of this reform farmers in the South-East can respond freely to the increasing demand for energy crops.

In addition to dedicated energy crops, agricultural by-products are a valuable resource for the production of energy. Tables 6.3 to 6.5 explore the energy potential of agricultural solids (i.e. straw) and liquids (i.e. cattle and pig slurry).

Table 6.3: Agricultural Solids

	Cereals (ha) Note 1	Straw (tonnes) Note 2	Availability (tonnes) Note 3	Energy (at 20% mc) (TJ) Note 4
South-East	99,600	547,800	76,692	**1,104**
State	279,800	1,538,900	215,446	**3,102**

Note 1 Based on the hectares planted with cereals in the Region (CSO data, 2006)
Note 2 Assume yield of 5.5 tonnes of straw per ha (average yields from different cereals)([27])
Note 3 Assume 14% availability of resource, based on a range of 7 – 22%([28])
Note 4 Calorific value of 14.4 GJ per tonne of straw at 20% moisture content ([28])

Table 6.4: Agricultural Liquids – Cattle Slurry

	Cattle Note 1	Slurry (tds) Note 2	16 Weeks Yield Note 3	Available (10%) Note 4	Biogas Yield (m^3) Note 5	Energy (TJ) Note 6
South-East	1,209,100	1,293,737	398,073	39,807	9,951,823	**239**
State	6,915,900	7,400,013	2,276,927	227,693	56,923,177	**1,366**

Note 1 CSO data, 2006
Note 2 Assume 1.07 tonnes of dry solid/year/animal ([27])
Note 3 Assume animals kept indoors for 16 weeks per year
Note 4 Assume 10% availability of resource ([27])
Note 5 Assume biogas yield of 250m^3 per tonne of dry solids ([27])
Note 6 Assume energy content of 0.024 GJ/m^3 ([27])

Table 6.5: Agricultural Liquids – Pig Slurry

	Pigs Note 1	Slurry (tds) Note 2	Available (75%) Note 3	Biogas Yield (m^3) Note 4	Energy (TJ) Note 5
South-East	309,900	37,188	27,891	6,972,750	**167**
Total	1,643,200	197,184	147,888	36,972,000	**887**

Note 1 CSO data, 2002
Note 2 Assume 0.12 tonnes of dry solid/year/animal ([27])
Note 3 Assume 75% availability of resource ([27])
Note 4 Assume biogas yield of 250m^3 per tonne of dry solids ([27])
Note 5 Assume energy content of 0.024 GJ/m^3 ([27])

6.5. Energy Crops within the South-East Region

The sustainable growth of specific energy crops is currently being encouraged by the Government with the recent announcement of establishment grants for the planting of willow and miscanthus, the energy payment which was announced in the 2007 Budget and the setting of ambitious targets for the penetration of liquid biofuels into the transport industry. The South-East Region is well-placed to contribute strongly to the production of energy crops nationally.

6.5.1. Oil Seed Rape

Oil seed rape (OSR) is the main energy crop that is currently being grown within the South-East Region. The production of pure plant oil (PPO) from OSR in Ireland offers two possibilities for the introduction of liquid biofuels into the transport fuel mix. The PPO can be used directly in modified diesel engines, or it can be supplied as a feedstock to a biodiesel plant for conversion to biodiesel. OSR is processed into biodiesel using well-established technologies as discussed in Chapter 7. Biodiesel can be used in compression ignition diesel systems, as a 5% blend with conventional diesel. Table 6.6 details the energy that can be derived from the current plantation of OSR within the Region.

Table 6.6: Current Crop of Oil Seed Rape

	OSR Crop (ha) Note 1	Energy (TJ) Note 2
South-East	1,900	**80**
State	5,100	**214**

Note 1 CSO data, 2006
Note 2 Assume energy content of 42 GJ/ha([29])

16% of the potential energy from OSR crops in Ireland is from crops that are planted within the South-East Region. With the demise of the sugar beet industry it is likely that the planting of OSR as an energy crop will increase. Given that almost half of the sugar beet crop in 2005 (44%) was planted in the South-East (CSO data), the potential now exists within the Region to significantly increase OSR production.

6.5.2. Willow & Miscanthus

Under the BioEnergy Scheme administered by the Department of Agriculture, Fisheries and Food, establishment grants are now being provided by the Government to encourage the growing of SRC willow and miscanthus for the generation

of energy. The first round of applications were accepted for the Scheme was accepted in February 2007. The Department has supplied information with regard to the successful applicants for the grant assistance and it is expected that another round of applications will be sought towards the end of 2007. Tables 6.7 and 6.8 detail the energy that can be derived from these plantations within the South-East Region.

Table 6.7: Potential Energy from SRC Willow in the South-East Region

	SRC Willow (ha) Note 1	Yield (t) Note 2	Energy (TJ) Note 2
South-East	22.85	228.5	**4**
State	107.56	1,075.6	**19**

Note 1 Information supplied by DAFF (2007)
Note 2 Assume an average yield of 10 tonnes/ha
Note 3 Assume an energy content of 18 GJ/tonne ([30])

Table 6.8: Potential Energy from Miscanthus in the South-East Region

	Miscanthus (ha) Note 1	Yield (t) Note 2	Energy (TJ) Note 2
South-East	282.96	2,829.6	**48**
State	895.16	8,951.6	**152**

Note 1 Information supplied by DAFF (2007)
Note 2 Assume an average yield of 10 tonnes/ha
Note 3 Assume an energy content of 17 GJ/tonne ([31])

6.5.3. Grass as an Energy Crop

Table 6.9 explores the energy potential if 5% of the land used for pasture within the South-East Region was used to produce grass as an AD feedstock.

Table 6.9: Energy Potential from Grass

	Pasture Land (ha) Note 1	Available Land (ha) Note 2	Yield (tonnes) Note 3	Energy (TJ) Note 4
South-East	285,200	14,260	71,300	**321**
State	1,932,700	96,635	483,175	**2,174**

Note 1 Source: CSO, 2006
Note 2 Assume 5% availability
Note 3 Assume yield of 5 tonnes/ha from pasture ([31])
Note 4 Assume energy content of 4.5 GJ/tonne ([31])

If grass was to be considered as an energy crop, then the South-East Region would be well placed to contribute to the national energy generation with 14.7% of the pasture land in Ireland contained within the South-East.

6.6. Municipal Solid Waste

The Joint Waste Management Plan for the South-East Region outlines the policy for the management of all MSW arisings within the Region for a 20-year period ([32]). The Plan has set out specific policy objectives for the collection and treatment of MSW.

It is a policy objective of the Plan that a 3-bin waste collection service be introduced across the Region to ensure the segregation of waste at source. It is intended that waste will be collected as three separate fractions:

1. Dry recyclables
2. Biowaste (organic fraction of MSW)
3. Residual waste.

Waste fractions 2 and 3 can be considered for the purpose of energy generation.

The quantities of biowaste and residual waste arisings predicted to be generated in the Region in 2011 are outlined in Table 6.10. 2011 has been selected as a reference because it is the design year for the Plan.

Table 6.10: Predicted Waste Arisings for 2011

Year	Waste Type	Tonnage	Biowaste Fraction (t)	Residual (t)
2011	MSW	336,400	53,000	140,500

In determining the biowaste fraction of MSW the organic faction of household and commercial wastes were assumed to be 35% and 21% respectively.

Of the 53,000 tonnes of biowaste predicted to be collected in the Region, 20,000 tonnes are committed as feedstock to the aerobic composting facility operated by Waterford City Council. The remaining 33,000 are available as a potential bioenergy resource together with all residual waste generated.

It is the policy of the Joint Waste Management Plan for the South-East Region that residual waste arisings be treated using thermal treatment incorporating energy recovery.

The potential bioenergy generation of these waste streams is outlined in Table 6.11. This scenario assumes that the residual fraction of waste will be thermally treated incorporating energy recovery (i.e. electricity generation) and the remaining biowaste fraction will be treated using anaerobic digestion.

Table 6.11: Potential Energy from MSW in the South-East Region

Waste Type	Tonnage	Biowaste Generation (M^3/yr)	Energy Generation (GW/y)	Energy (TJ/year)
Biowaste	33,000	330,000	77	277
Residual	140,000	-	128	461
TOTAL	173,000		**205**	**738**

The South-East Waste Management Region has initiated a Public Private Partnership (PPP) procurement process for the provision of a thermal treatment facility with a nominal treatment capacity of 150,000 tonnes per annum.

As this project is in the very early stages of procurement and its development is subject to legislative and market forces, the potential energy contribution from residual waste management has not been considered in the target setting for bioenergy deployment within the Region. The progress of this project will be kept under review by the Region for future energy potential.

It is intended in the Joint Waste Management Plan that the treatment of the remaining biowaste fraction will be provided by the private sector.

6.7. Landfill Gas

Landfill gas (LFG) produced from waste is also a resource that can be utilised for energy production. At landfill sites, the natural digestion of the organic fraction of waste by bacteria under partially anaerobic conditions produces a biogas. This gas consists primarily of methane and carbon dioxide in the ratio of 2:1.

The methane in LFG is a highly flammable greenhouse gas which can be recovered from the landfill and combusted to produce energy.

The active landfill facilities in the South-East Region are:

- Powerstown Landfill, Co. Carlow
- Tramore Landfill, Co. Waterford
- Donohill Landfill, Co. Tipperary
- Dunmore Landfill, Co. Kilkenny
- Kilbarry Landfill, Waterford City
- Killurin Landfill, Co. Wexford.

Due to the age and nature of these landfills, none are producing sufficient quantities of landfill gas to be utilised for energy. A new landfill is currently under construction at Holmestown, Co. Wexford. Landfill gas generation at this facility will be monitored to determine if landfill gas utilisation is viable in the future. Powerstown Landfill is currently being extended and this facility will be considered for future energy generation.

The Landfill Directive ([33]) aims to reduce the amount of organic waste being sent to landfill and, thus, the nature of waste being sent to landfill in the future will change. The decreased organic content of future waste will mean that landfill gas generation will decrease when compared to past production.

6.8. Potential to Increase Energy Production within the Region

This section outlines the potential to increase the bioenergy resource of the South-East Region by increasing the growth of key energy crops. The increased production of energy crops will provide an opportunity for the agricultural sector within the Region and will strengthen fuel supply chains.

6.8.1. Potential to Expand OSR Crop

This scenario to expand the energy potential within the South-East Region involves replacing 75% of the area previously planted with sugar beet with oilseed rape.

Table 6.12: Potential Energy from Increased OSR Production

	Previous Sugar Beat Area (ha) Note 1	OSR Crop (ha) Note 2	Energy Potential (TJ) Note 3
Carlow	3,508	2,631	111
Kilkenny	1,668	1,251	53
Waterford	929	697	29
Wexford	6,934	5,201	218
South Tipperary	1,314	986	41
Total	14,353	10,766	**452**

Note 1 Information supplied by DAFF (2007)
Note 2 Assume an average yield of 10 tonnes/ha
Note 3 Assume an energy content of 18 GJ/tonne ([30])

6.8.2. Bioethanol from Sugar Beet

Should a bioethanol plant be developed within the State then there would be a potential to continue growing sugar beet for the production of bioethanol. Table 6.13 explores the energy potential if 50% of the current area planted with sugar beet was to be retained as an energy crop.

Table 6.13: Potential Energy from Bioethanol Production

	Previous Sugar Beat Area (ha) Note 1	OSR Crop (ha) Note 2	Energy Potential (TJ) Note 3
Carlow	3,508	1,754	173
Kilkenny	1,668	834	82
Waterford	929	464.5	46
Wexford	6,934	3,467	343
South Tipperary	1,314	657	65
Total	14,353	7,176.5	**709**

Note 1 Information supplied by DAFF (2007)
Note 2 Assume an average yield of 10 tonnes/ha
Note 3 Assume an energy content of 18 GJ/tonne ([30])

6.8.3. Potential to Increase Willow/Miscanthus Production

With the recent introduction of establishment grants for short rotation coppice (SRC) willow and miscanthus, there is a great incentive for farmers within the South-East to establish these crops for energy.

Table 6.14 explores the potential energy that could be generated should 10% of the pasture land within the South-East be planted with SRC willow or miscanthus. The energy generation capacity of both crops is similar.

Table 6.14: Potential Energy from Increased Willow/Miscanthus Production

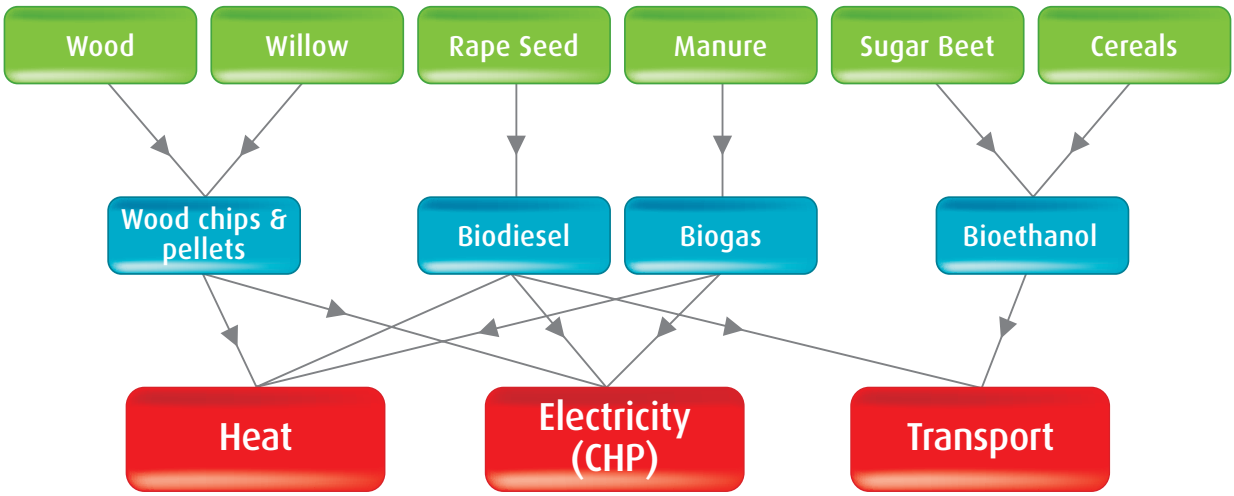
	Pasture Land (ha) Note 1	Willow/Miscanthus Crop (ha) Note 2	Yield (tonnes) Note 3	Energy Potential (TJ) Note 4
South-East	372,200	37,220	372,200	6,700

Note 1 CSO data, 2004
Note 2 Assume 10% planting of SRC willow/miscanthus
Note 3 Assume yield of 10 tonnes/ha
Note 4 Assume energy content of 18 GJ/tonne([31])

6.9. Application of Bioenergy Resources

Figure 6.1 links the raw materials currently available in the South-East Region with the appropriate end-use sector: heat, electricity and transport. The proven and available conversion technologies which link these raw materials with the relevant end sector are discussed in Chapters 7 and 8.

Figure 6.1: Flow Diagram from Raw Material, Biofuel to Energy Sector



7. TECHNOLOGY DESCRIPTION OF BIOFUEL PRODUCTION

This Chapter provides an introduction to the proven technologies that are used for the processing of the bioenergy resources, as discussed in Chapter 6, for the production of energy in the three sectors: heat, electricity and transport. The focus of this chapter is on technologies that are proven and available within the South-East Region.

7.1. Wood Fuel Production

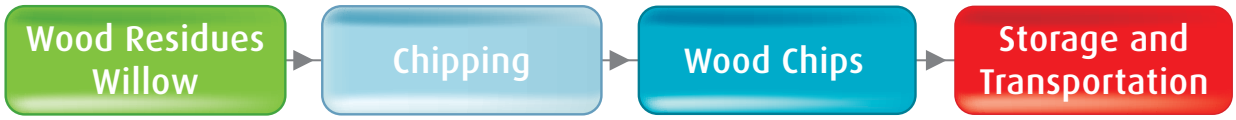
Wood fuel can be used for the production of heat and/or electricity in the residential, commercial/industrial and agricultural sectors across the South-East Region. The Region has a large wood resource which, if managed in a sustainable way, can meet a significant proportion of the heating/electricity requirements of the Region.

Firewood is one of the oldest and most widely used fuel sources and is widely available in the South-East. Most firewood is produced using processors which cut and split the logs into suitable lengths. Tree trunks and branches tend to be cut and then stacked to dry for a period of 12 months. Firewood can be used in open fires, closed stoves or in small-scale central heating systems.

Wood fuel production also includes wood chips and wood pellets which are produced from forest wood residues, industrial wood residues or willow. The production of wood chips and pellets are both considered mature technologies. Forest wood resources and willow are only used to produce wood chips, while industrial wood resources are used for production of both wood chips and wood pellets.

7.1.1. Wood Chips

Figure 7.1: Flow Diagram of Wood Chips Production

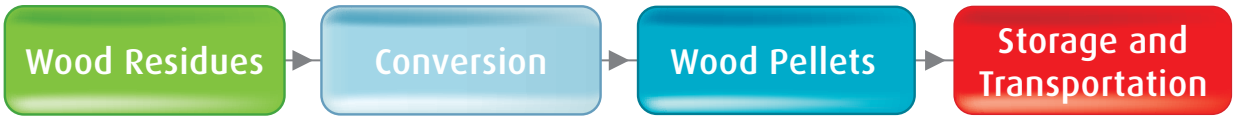


The energy content of wood fuel is directly related to the moisture content: dry wood has about 40% of the calorific value of oil by weight, whereas freshly cut wood has less than 20% ([34]). The moisture content of trees is generally lowest during the first three months of the year and this is the best time for felling. The felled wood is left in the forest for drying during the summer months. In addition, the needles and small branches detach during the drying period which ensures that most of the nutrients remain in the area. The moisture content generally falls from 50-55% to 35-45% during the drying period.

Willow is generally harvested four years after establishing the crop and thereafter the crop is harvested every three years. The crop should ideally be harvested during the Winter period, chipping should be performed directly following harvesting and the willow stored as wood chips. Alternatively, chipping can be performed at delivery. In order to balance supply and demand, seasonal storage of the chips is required.

7.1.2. Wood Pellets

Figure 7.2: Flow Diagram of Wood Pellets Production



Dry industrial wood waste, such as shavings, sawdust and sander dust, is used to produce wood pellets. At high pressure the wood waste is forced through a die which forms the pellets in the desired shape and size. The lignin and resin content of the wood act as natural binding agents so no additional additives are required. After pressing, the pellets are cooled and dust is removed. Economically it is less advantageous to produce wood pellets from forest wood.

Several pellet production plants are operational in both Ireland and the UK with more planned for the near future. Pellets are also being imported from Continental Europe and other areas ([35]).

Wood pellets are becoming a popular, renewable fuel for the residential market in the South-East as they are compact, uniform in size, easy to store and handle and to use in pellet boilers and stoves.

7.1.3. The Distribution of Wood Chips and Pellets

Wood chips are generally delivered in bulk and storage solutions, such as an underground tank or container units are required. Wood pellets can be purchased in bags or by bulk and are available from a number of suppliers and producers throughout the Region. Typically, wood chips are more appropriate for commercial/industrial users and/or rural users whereas wood pellets are more suitable for urban and/or domestic users.

7.2. Biodiesel Production

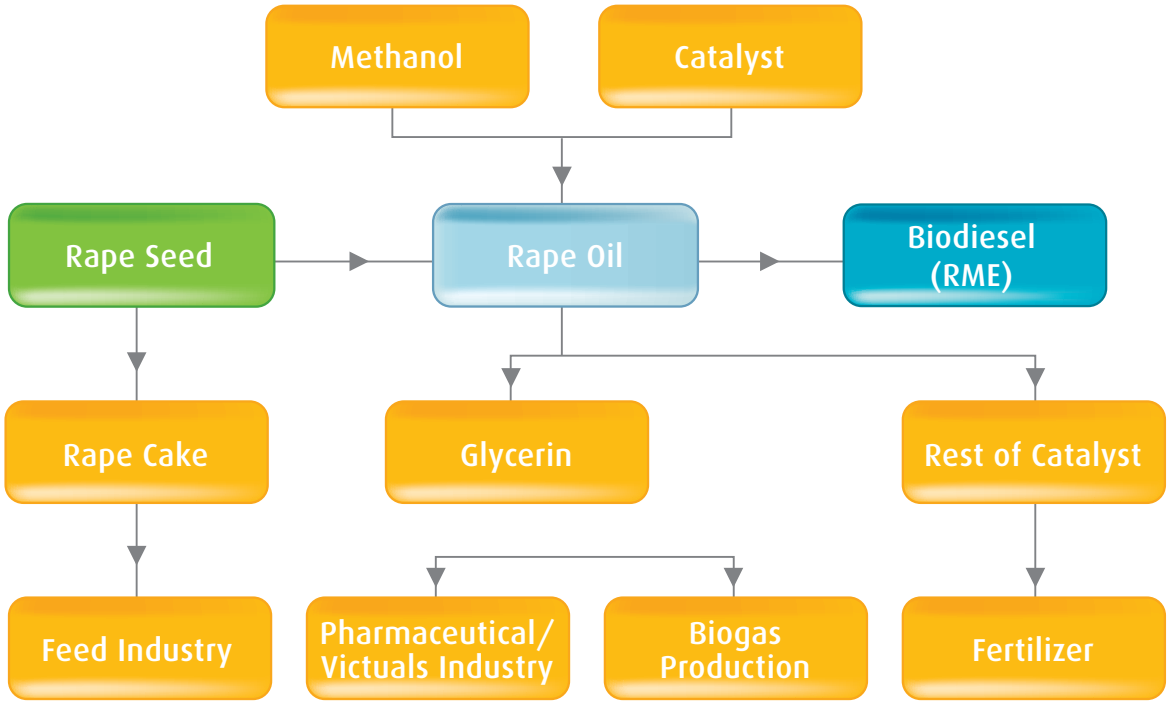
In Ireland, the most likely form of biodiesel is Rape Methyl Ester (RME), produced from oilseed rape, and the production process is illustrated in Figure 7.3.

The oil is extracted from the seed in a pressing process. Depending on the size and nature of the extraction process, 80-90% of the oil in the rape seed oil is extracted.

The rape oil undergoes a transesterification process where methanol and a catalyst (normally kalium hydroxoide (KOH) or natrium) are added. The main product from this transesterification process is biodiesel.

Rape oil, or pure plant oil (PPO) as it is called, can be used as a transport fuel in vehicles with modified engines. PPO is currently produced in the South-East Region by a small number of companies and supplies captive fleets that have undergone engine modifications. PPO will make a contribution to the achievement of the national targets in line with the Biofuels Directive. The Bioenergy Implementation Plan, however, focuses on mainstream biofuels that do not require any adaptations to the common transportation fleet. Thus, biodiesel produced from oilseed rape, which can be blended with conventional diesel and sold at ordinary filling stations is the focus of the Plan.

Figure 7.3: Flow Diagram of Biodiesel (RME) Production



Co-Products

The co-product from the process of rape oil production is rape cake which can be utilised as an animal feed.

The co-products from the transesterification process are glycerine and a catalyst residue. The first can be exploited in the pharmaceutical or the victuals industry or it can be digested to produce biogas. The second co-product can be utilised as fertiliser.

7.3. Bioethanol Production

Figure 7.4 illustrates the process of bioethanol production from sugar beet and cereals.

The main difference between the production of bioethanol from sugar beet and cereal is in the process before fermentation. The easiest way to produce bioethanol is to use feedstock which contains six-carbon sugars, as the pre-treatment of the biomass is simple compared with feedstock containing starch. This technology is considered mature and is widely used.

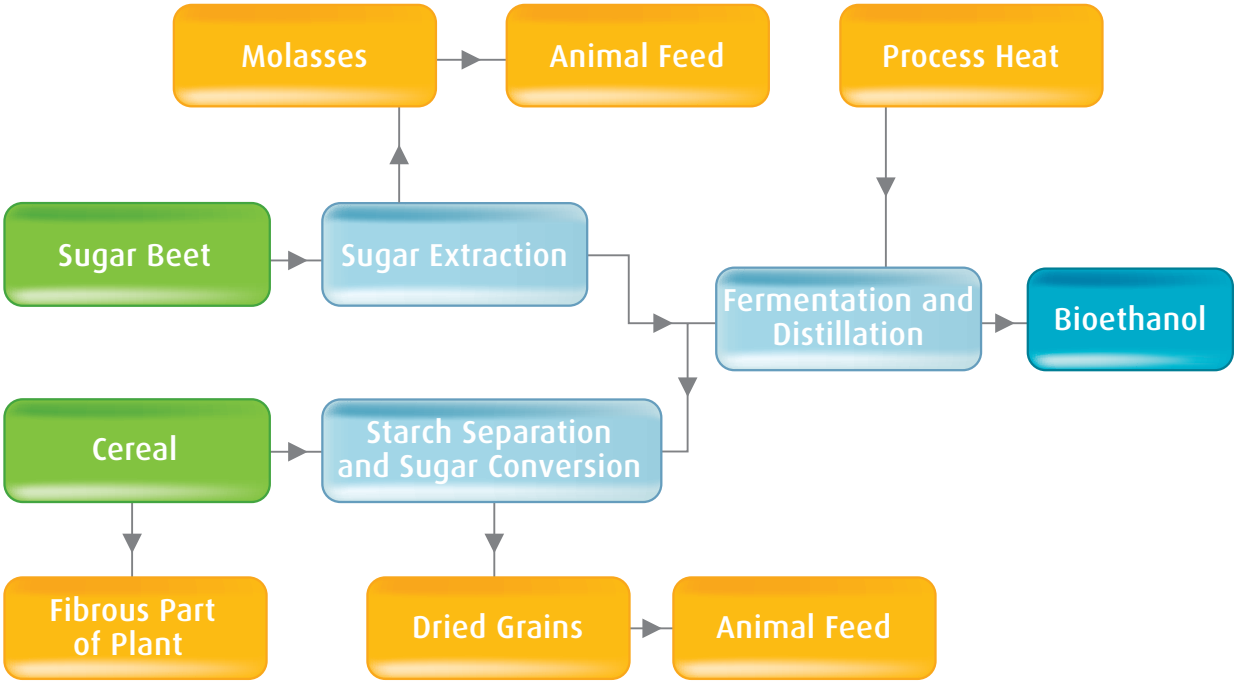
Pre-treatment

During the pre-treatment of sugar beet the sugar is extracted by crushing, soaking and pressing. Once the sugar has been extracted it is ready for the fermentation process.

During the pre-treatment of cereal the starch is first separated from the cereal and then converted to sugar. Only the starchy part of the cereal is used for bioethanol production. Pre-treatment involves the separation, cleaning and milling

of the cereal and the latter can be done in either a wet or a dry process. In the wet milling process the conversion of starch is done after separation and in the dry milling process the sugar conversion is done during the separation. In either method the conversion is typically achieved by hydrolysis.

Figure 7.4: Flow Diagram of Bioethanol Production



Fermentation and Distillation

During the fermentation process the sugar is fermented into alcohol using yeast and other microbes. When the fermentation is complete the liquid is distilled to obtain the desired concentration of ethanol as water and solids are separated from the alcohol.

Co-Products

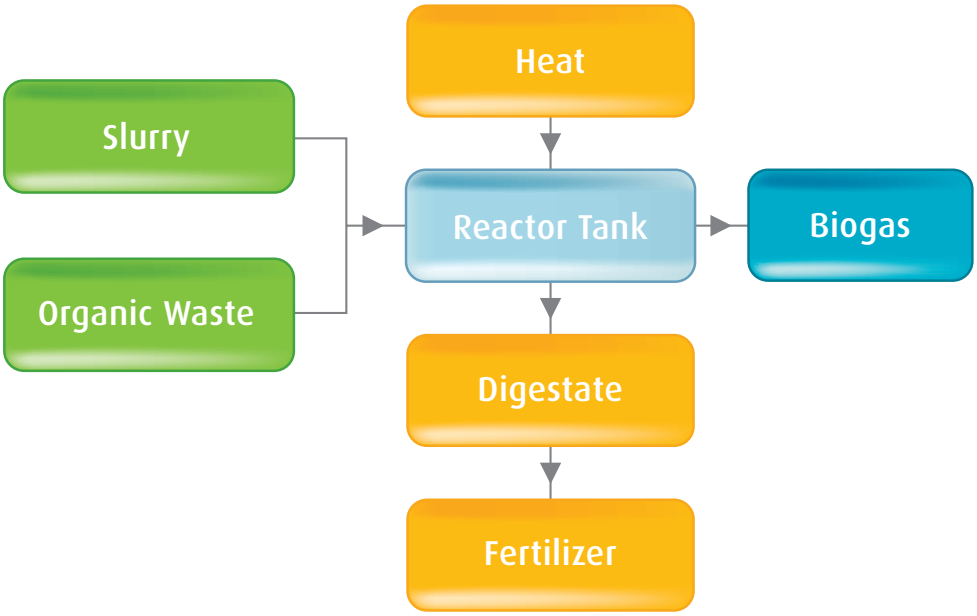
Animal feed is one co-product of ethanol production from both sugar beet and cereal. The starchy part which is utilised in ethanol production only represents a small part of the crop, while the residue contains a considerable amount of fibres.

7.4. Anaerobic Digestion

Anaerobic digestion (AD) is a method used to treat agricultural and other organic wastes. Anaerobic bacteria convert part of the biomass into biogas which can be used to generate energy.

Figure 7.5 shows the process of biomass conversion to biogas. The biomass is fed into the reactor tank where it is heated and kept for 2-3 weeks. The biogas production is dependant on different parameters such as the moisture content of the waste and the temperature and retention time in the digestion tank.

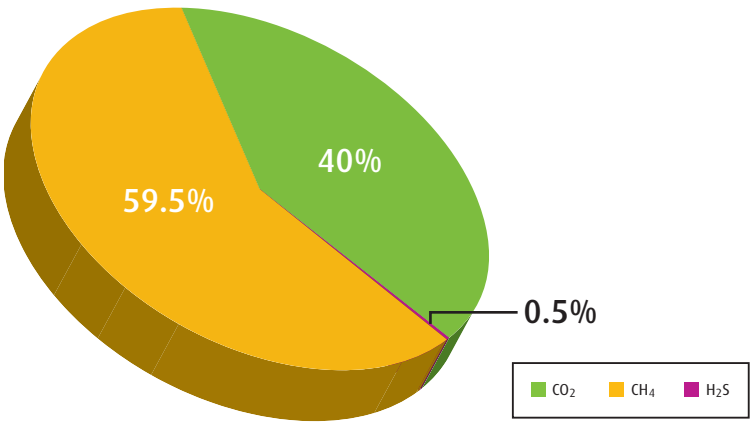
Figure 7.5 Flow Diagram of Biogas Production



Traditionally, reactors operate in two different temperature ranges; mesophilic plants use a digestion temperature of 35-39˚C and thermophilic plants have a digestion temperature of 52-55˚C. The composition of the biomass determines whether the plant should be operated in the mesophilic or the thermophilic temperature area. About one third of the dry matter is converted to biogas.

Biogas typically consists of methane (CH_4), carbon dioxide (CO_2) and hydrogen sulphide (H_2S) and the composition is illustrated in Figure 7.6. H2S which is toxic is usually removed from the gas. Methane is the energy carrier and is utilised to produce heat, electricity or both. However, the process energy to operate the plant should be taken into account. The share of biogas used for process energy is dependant on different parameters such as the temperature range of the reactor and the composition of the biomass.

Figure 7.6: Content of Biogas



7.4.1. Co-product from Biogas Production

The digestate from biogas production can be used as an agricultural fertiliser. It has several advantages over raw slurry: it is more homogeneous, the nitrogen availability is higher, the penetration of nitrogen to ground water is reduced, and the odour is significantly reduced. In the case of excess of nutrients in an agricultural area, nutrients may be separated from the digested slurry and exported out of the area. However, a suitable storage of this co-product is necessary as the risk of nitrogen loss is high due to the evaporation of ammonia. Thus, some sort of cover which prevents contact between the atmosphere and the digestate is essential.

Two different biogas productions are briefly introduced below:

- Farm Scale Biogas Production
- Centralised Biogas Production.

In Europe, the trend in biogas plants is towards larger plants due to the economies of scale of the technology, i.e. larger farm-scale biogas plants as well as larger centralised biogas plants.

7.4.2. Farm-Scale Biogas Production

In the case of farm-scale biogas production the feedstock originates from agricultural waste from one holding and, if convenient, also from a neighbouring farm. Industrial or municipal organic waste can be added to increase the biogas production.

In a farm scale production about 25% of the total gas production is used as heat and electricity to operate the plant. Typically 25,000 tonnes of slurry, to which organic waste should be added, are treated on an annual basis in a small scale biogas production. This corresponds to about 530,000m^3 of biogas per year. The technology is considered to be mature.

7.4.3. Centralised Biogas Production

In the case of centralised biogas production slurry is supplied from several holdings in the local area. Additionally the plant may be supplied with different types of organic waste, which can include some of the following: waste from slaughterhouses and the food industry, wastewater sludge and sorted organic waste from domestic households. After processing the digestate is divided between the different suppliers and can be used as an agricultural fertilizer.

About 16 % of the total biogas production in a centralised plant corresponds to the heat and electricity necessary to operate the plant and to transport the manure to and from the different holdings. The process energy's share of the total production is relatively less than for a farm scale production, indicating that centralised production is more efficient. Surplus electricity is delivered to the national grid, while surplus heat is generally used for district heating purposes.

8. APPLICATION & INFRASTRUCTURE

In this chapter the conversion technologies for the different biofuels described in Chapter 7 are discussed with regard to their application across the South-East Region in the three energy sectors: heat, electricity and transport.

8.1. The Heat Sector

Heating Boilers can be roughly divided into three size categories:

- Individual domestic boilers (typically in the range of 5 to 30 kW)
- Commercial and small industrial boilers (typically in the range of 30 kW to 1MW)
- Large industrial boilers and district heating boilers (typically in the range of 1 to 50 MW).

With regard to wood-fuel fired boilers it should be noted that pellets may be more suitable for urban and/or domestic use, while chips may be more appropriate for commercial/industrial and/or rural use.

Over the past few years a number of different projects have been undertaken within the South-East Region involving switching from conventional fossil fuels to bioenergy for the provision of energy for heat, electricity and transport fuels. A selected number of projects are presented in Appendix 2.

8.1.1. Small-Scale Heating Boiler, Wood-Fuel Fired

Small-scale biomass fired boilers can be installed in residential dwellings, in commercial buildings and in small industries. During the last 10 years the development of the combustion technology has led to an increase in the efficiency and a reduction in the emissions of carbon monoxide (CO) and dust. The success of SEI's Greener Homes Scheme which provides grants for the installation of domestic biomass boilers has seen an increase in the uptake of these heating systems in homes across the South-East Region. Support for this scheme was increased in the Budget 2007 and so this trend is expected to continue.

Two types of small-scale biomass fired boilers are available - the automatically fired and the manually fired boilers. Automatically fired boilers are the most commonly used.

An automatically fired boiler has a silo for chips/pellets and a screw feeder that feeds the fuel according to the output demand. Typical efficiencies and CO emissions based on nominal output are 80-90% and 100 ppm respectively. It is, however, possible to reach an efficiency and a CO emission of 92% and 20 ppm respectively. During the Summer when the demand is only based on hot water heating the efficiency may drop to 20-30%. Thus, it is important to design the boiler as close to the maximum demand as possible. However, if the boiler is linked to a buffer tank, it may run at full load and thereby increase efficiency. Besides, If the boiler is combined with a separate water heater for use during the Summer, the annual efficiency would increase as well.

In order to avoid too frequent feeding during colder months the nominal output for a manually fired boiler is designed for two to three times the demand of the dwelling. This generally means a reduced efficiency as part load operation reduces the efficiency. Manually fired boilers should have a storage tank as it results in better user comfort and reduced financial and environmental strain. The efficiency of manually fired boilers is generally within the range of 75-90%.

8.1.2. Medium-Scale Heating Boilers, Wood-Fuel Fired

Medium-scale boilers based on wood chips in the range of 30 kW to 1 MW can be utilised by the commercial sector and in smaller industries for the generation of heat. The installation of these boilers is supported and encouraged by the SEI ReHeat Deployment Programme. The levels of grant assistance available for biomass boilers are outlined in Chapter 3.

Within the South-East Region, a number of institutions and private businesses have switched to wood fuelled systems for the provision of space and hot water heating. The main driving forces for these projects were increasing fossil fuel costs and a desire by the owners to predict their energy costs more accurately. Other advantages of bioenergy heating systems are the decreased CO_2 emissions and a decrease in sulphur emissions. A selection of these projects is presented in Appendix 2.

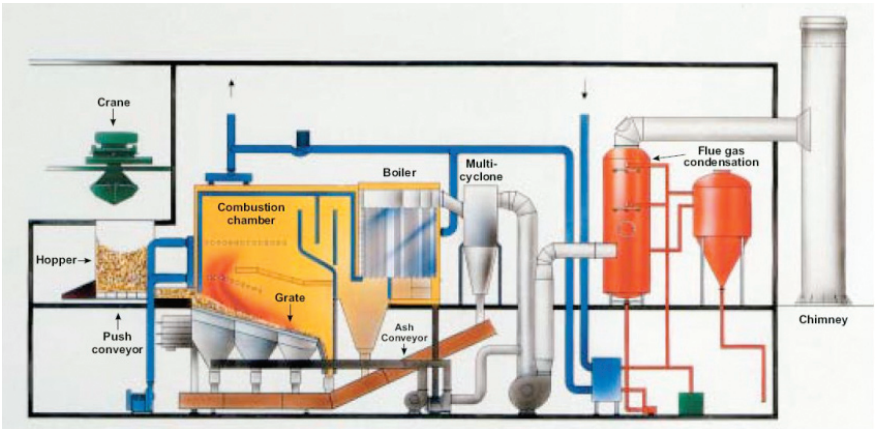
8.1.3. Large Scale Heating Boiler / Plant, Wood-Fuel Fired

Large scale biomass fired boilers can be installed in large industries or in district heating plants.

A district heating plant produces heat which is distributed to an established district heating system. Biomass district heating plants can either replace oil or coal fired plants or be established in combination with existing systems. This section considers solely wood chip fired heating plants. These district heating boilers generally have a capacity of 1 – 50 MW and an availability factor of 96-98%. Average distribution loss is generally about 28%. The viability of such a system depends on different criteria such as the population density and the heat demand.

Figure 8.1 shows an example of a district heating plant which is located in Denmark. The list below gives a short introduction to the main components which normally are included in all systems.

Figure 8.1: Example of a District Heating Plant in Thyboroen, Denmark ([35])



Wood fuel storage	The size of the storage depends on various factors. However, it is advisable to have a storage that equals the consumption for 5 days at maximum heat demand.
Fuel treatment	Implies the transport between the storage and the feeding system. Different fuel handling systems are available and parameters such as system size and fuel characteristics influence the choice of system.
Feeding system	The feeding system feeds the combustion chamber with fuel and various types of feeding systems exist. Important parameters for the choice are the plant size and the fuel composition.
Chamber and boiler	Normally the combustion chamber is situated below the boiler. When the flue gasses reach the boiler, heat is transmitted to the circulating water.
Flue gas cleaning	Fly ash is the part of ash which remains in the flue gasses after the boiler. The aim with cleaning is to reduce the amount of ash going through the chimney. Different types of cleaning equipment are available, e.g. Multicyclone, bag filter or electrostatic precipitator. In Figure 8.1 a multicyclone is applied.
Flue gas condensation	Water vapour in the flue gas represents unutilised energy. When the vapour condenses heat is released which increases the total efficiency of the system. The return water from the district heating system is used for cooling and for that reason the return water should be as cold as possible.

8.2. The Electricity Sector

The principal technology for generating electricity from bioenergy resources is a combined heat and power (CHP) system, which generates electricity and heat simultaneously. The basic components of all CHP-Plants are an engine or turbine, driving an electrical generator combined with a heat recovery system.

Due to the utilisation of the heat produced during electricity generation and by avoiding transmission losses, because the electricity is generated on site, a CHP-Plant can achieve energy efficiencies of upwards of 80%.

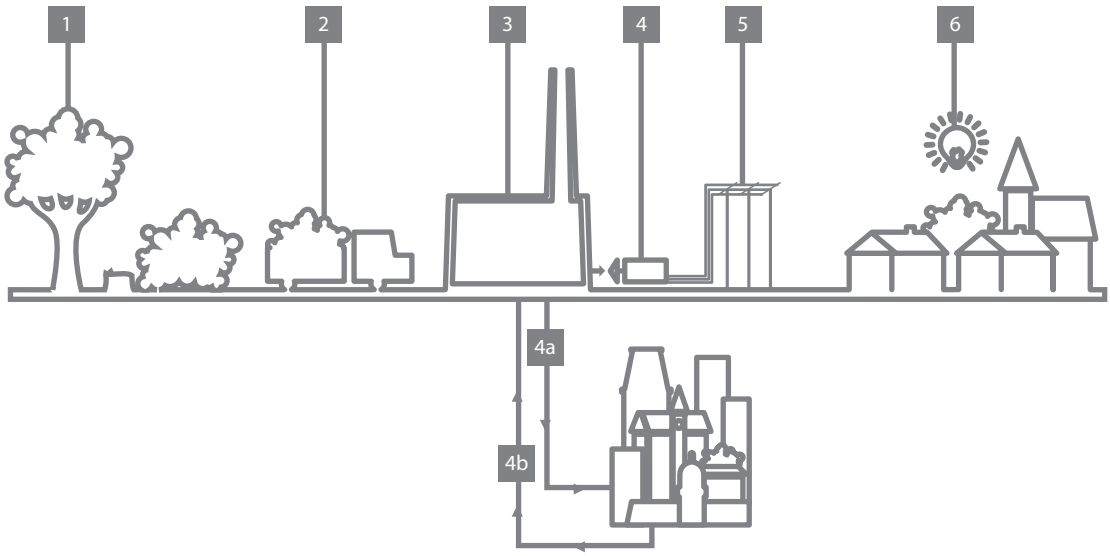
In the following sections, a wood-fuel-fired steam turbine and a biogas engine are described.

8.2.1. CHP-Plant, Wood-Fuel Fired

In a traditional coal or natural gas fired power plant 40-45% of the energy in the fuel is used to generate electricity. This implies that 55-60% of the energy is wasted through the cooling water and the flue gas through the chimney. In a CHP-Plant a major part of the waste heat is utilised for heating purposes. CHP technology can be used for industrial enterprises with large and continuous heat demands and also in district heating systems.

In Figure 8.2 a biomass CHP system is illustrated where both the feedstock and the end user are included. The manufactured wood chips are supplied to the CHP-Plant which produces electricity. Waste energy is utilised as district heating in the surrounding neighbourhood.

Figure 8.2: Combined Heat and Power Diagram (source: www.districtenergy.com)

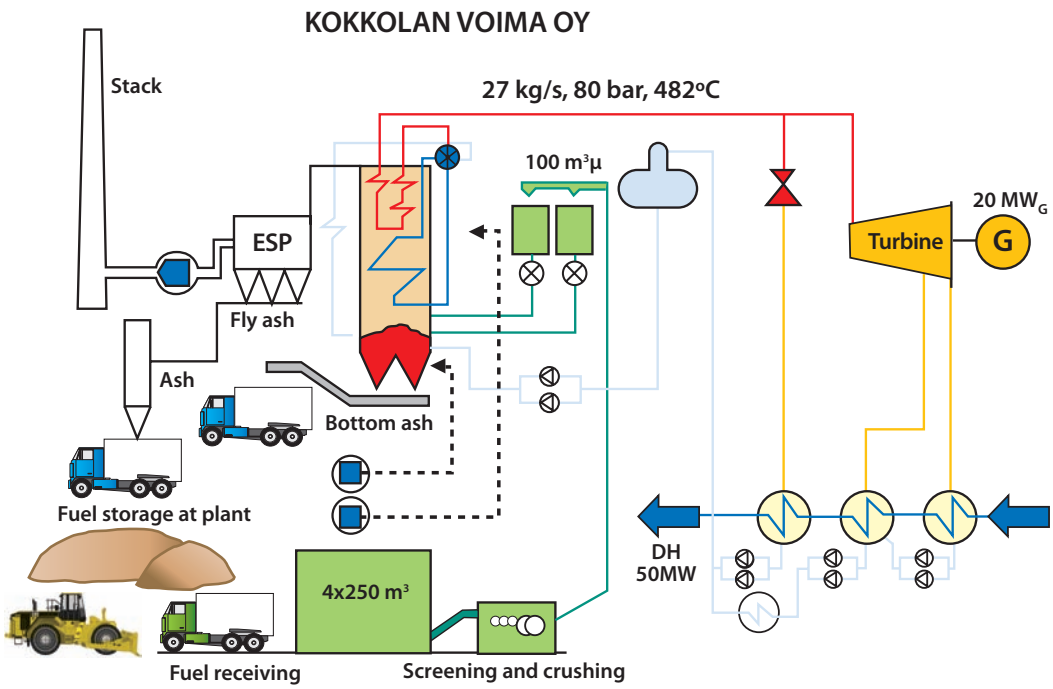


In a biomass-fired CHP-Plant the energy from steam condensation is accumulated in the water of the district heating system, increasing the total energy utilisation to 85%. The distribution of energy between electricity and heat is about 25% and 60% respectively.

Biomass with a moisture content of up to 60% can be used in a CHP biomass system. Applicable fuels include wood residues, straw and energy crops. The CHP-Plant can also combine biomass with fossil fuels such as coal if the biomass supply is limited.

Figure 8.3 shows a schematic representation of a CHP-Plant. A short introduction to each component is presented below.

Figure 8.3: Schematic Diagram of a CHP-Plant Including Biomass Treatment in Kokkola, Finland ([36])



Wood fuel storage	Fuel storage to reduce risk of fuel supply shortage.
Fuel treatment	Before the fuel is supplied to the boiler it is screened and crushed.
Steam boiler	The fuel is supplied to the boiler and high pressure steam is produced. The bottom ash is extracted and disposed of. Various types of furnace technology are available – such as grate firing, suspension firing and fluidised bed.
Turbine	The high pressure steam drives the turbine, which in turn drives the electricity generator.
Heat exchanger	The low pressure steam is cooled and condensed by the district heating system. Thereby the waste heat from the electricity production is utilised in the district heating system.
Flue gas treatment	Fly ash is the part of ash which remains in the flue gas after the boiler. Different types of cleaning equipment are available, e.g. Multicyclone, bag filter or electrostatic precipitator (ESP). In the plant illustrated in Figure 9.3 ESP is applied.

Usually the plant size is determined by the heat demand that must be met by the CHP-Plant. Plant sizes typically range from 5 to 20 MW.

Fossil fuel-fired CHP technology is well established and available in the South-East Region and its deployment is being encouraged by the SEI CHP Deployment Programme which supports the use of small-scale fossil-fired CHP applications ranging from 50 kW to 1MW. However, this Program has not so far supported CHP, based on solid biomass.

SEI will, however, shortly launch a support programme for biomass-fired CHP-Plants and AD-based CHP-Plants. This Scheme, which is expected to be introduced by the end of Summer 2007, will provide financial assistance for the installation of these bioenergy technologies across the State. The Scheme is expected to provide assistance of up to 35% of the installation costs.

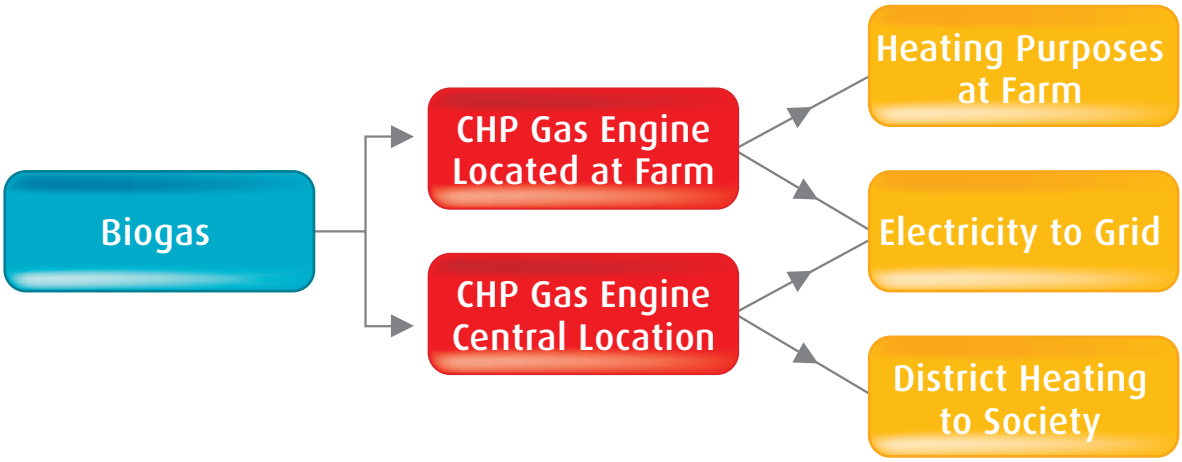
8.2.2. Biogas CHP Engines

Biogas energy can be converted to electricity and heat. The waste heat can be utilised in either a district heating system or for process heating purposes. The utilisation of biogas in a combustion engine is a reliable and proven technology. Typical capacities for a biogas CHP engine are within the range of 5 kW to 8 MW. It is possible to operate at part load although with slightly decreased electricity efficiencies.

On a farm plant the electricity can be sold to the national grid and the heat is used in the process of biogas production and to heat the farm buildings. At a centralised plant the electricity is also sold to the grid but the heat can be distributed to the neighbourhood in a district heating system.

The different application and distribution possibilities are illustrated in Figure 8.4 below.

Figure 8.4: Diagram of Biogas Application



8.3. The Transport Sector

The predominant application of biofuels for the common transportation fleet in the South-East Region is as blends with conventional diesel and petrol. The main advantage of blends, compared with pure biofuels, is that existing transportation fuel specifications can be met, so the fuel can be used in all vehicles without adaptations to the engines. Pure biofuels, such as PPO, are also produced and used in the Region in a number of captive fleets with engine conversions.

8.3.1. Biofuel Blends

A number of European Directives cover the technical requirements, including the chemical composition, for petrol and diesel.([37,38])

Diesel must meet the EN590 European standard for diesel. EN590 allows the blending of diesel with up to 5% biodiesel, providing the biodiesel used meets the EN 14214:2001 specification, also referred to as the FAME specification. Bioethanol is available as E85, which is an 85% blend of bioethanol with conventional petrol, or more generally as E5 which is a 5% blend of bioethanol with petrol. If bioethanol is converted to ETBE (ethyl-tertiary-butyl-ether) a 15% blend can be used, which is equal to 7% bioethanol.([39])

Biofuel blends of greater than 5% are required to be clearly labelled at the point of sale.

8.3.2. Infrastructure and Distribution of Biofuels

The requirements in relation to biofuel distribution infrastructure depend on the user demand. Users may be grouped into regional and interregional users.

Regional users are characterised as users within the Region with the ability to refuel at the same site when required. Examples of these consumers are regional carriers, public transportation such as buses or local authority functions such as home help or health visitors. Filling possibilities can, in this context, be made in several ways: individual filling

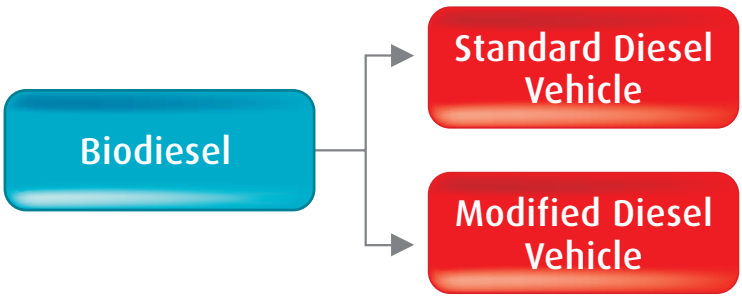
stations located near the relevant industries or in combination with existing filling stations. However, the establishment of some sort of mixing facilities would be necessary for the latter model. Distribution of pure biofuel also requires separate pumps. The advantage with filling at existing stations is that private customers also can benefit from the biofuel.

If the users are interregional they demand refuelling outside the Region. These users could typically be interregional carriers or personal transportation. In this case the biofuel distribution infrastructure needs to be more extensive as filling stations in general need to integrate biofuel. Alternatively the engines need to be flexible so they can use pure biofuel and/or traditional fuel.

Already within the South-East Region, there are a number of filling stations that sell E85 bioethanol which can be used in flexible fuel vehicles. This biofuel is manufactured from whey, which is a milk derivative, by the Carbery Group in Cork.

8.3.3. Diesel Vehicle

The standard for biodiesel, EN590, allows mixing of up to 5% biodiesel with conventional diesel. Thereby every engine manufacturer has accepted that this blend should not influence the guarantee of the vehicle. Higher mixing percentages may be used in conventional diesel engines but this may affect the engine warranty. In the event of engine damage, car manufacturers will honour the warranty where proper fuel was used, i.e. fuel which meets with the relevant fuel standards (EN590 for conventional diesel; EN14214 for biodiesel).



The most serious problem with the use of higher biodiesel blends is the lack of sufficient oxidation stability of the fuel. This can cause polymerisation of the fuel and the formation of sludge which damages the engine([35]).

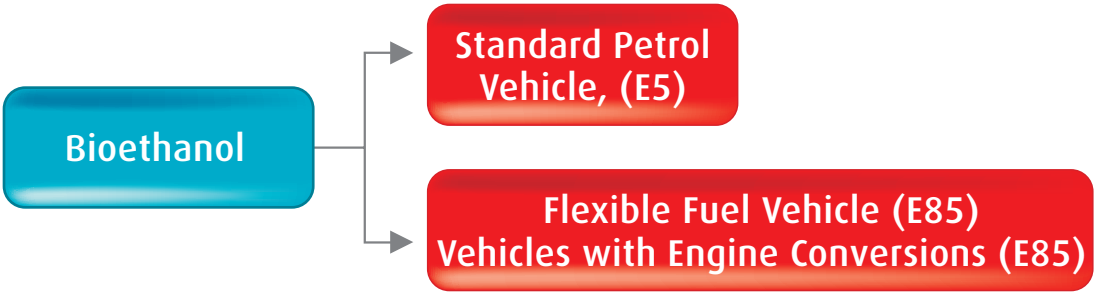
In May 2006, Dublin Bus launched a fleet of tour buses which were fuelled by a 5% biodiesel blend. In the Bioenergy Action Plan, one of the objectives of the Department of Transport was to ensure that all CIE transport companies move towards using a 5% biodiesel blend in all their existing fleets. This will provide a significant demand for biodiesel within the South-East Region.

In addition, construction has begun on the State's first biodiesel processing plant, which will be located in New Ross, Co. Wexford. This facility, which is being developed by Green Biofuels Ireland Ltd., will produce 32 million litres of biodiesel per annum. This project is presented in Appendix 2.

8.4. Petrol Vehicles

Bioethanol can easily substitute 5% of the petrol and still be fully compatible with existing petrol engines. A blend with 5% bioethanol in gasoline is called E5. E85, which is a blend of 85% bioethanol with conventional petrol, can be used in vehicles with modified engines and also in 'Flexible Fuel Vehicles' (FFV).

The FFV is a developed system for using higher blends of petrol and bioethanol. It is called the "Flexible Fuel Vehicle" which is designed to operate on 85% blend of bioethanol and petrol (E85). A sensor in the system analyses the composition of the fuel and adjusts the fuel injection and the ignition accordingly. The Ford Focus FFV, the Saab 9-5 BioPower and the Volvo S40 and V50 are currently available on the Irish market. These FFVs qualify for a 50% reduction in Vehicle Registration Tax (VRT) in Ireland, compared with a corresponding petrol-powered model.



Section Three

The Viability of Bioenergy as an Alternative Energy within the South-East Region

SOUTH-EAST REGIONAL AUTHORITY
ÚDARÁS RÉIGIÚNACH AN OIR-DHEISCIRT

9. VIABILITY ANALYSES OF BIOENERGY TECHNOLOGIES

The purpose of the viability analyses and assessment is to assess which bioenergy resources can provide viable energy to the South-East Region under the current market conditions (fuel prices, source, energy taxes and subsidy schemes from the Government). It should be noted that any change in the current market conditions will affect the viability analysis and, therefore, these results should be treated as indicative rather than conclusive. The results from the viability analyses were used in devising the regional targets for the development of the bioenergy market for the Region.

9.1. Methodology

The methodology which was applied in this chapter can briefly be summarised as follows:

1. Selection and definition of three case studies, representing each sector – heat, electricity and transport - Section 9.2. Each case study includes a bioenergy system and a relevant reference system (conventional fossil energy systems) for comparative purposes.

2. Selection of the appropriate investor types for the case studies (energy utilities, industries, the agricultural sector or private consumers), and determination of their anticipated requirements for financial viability (willingness to invest) - Section 9.3.

3. Determination of the necessary assumptions in order to conduct the viability calculations - Appendix 2. These assumptions are grouped as follows:
   - Non technology-specific assumptions. These include: general assumptions (VAT and tax levels) and energy consumption in the case studies
   - Fuel conditions, which include current fuel prices for fossil and wood fuels, tariffs for the purchase of electricity and transport fuel costs
   - Technology specific assumptions. These include:
     - Investments and maintenance costs
     - Current incentive schemes.

4. Analysis of financial viability, including relevant sensitivity analyses, and the presentation of the results and conclusions regarding the financial viability of the selected technologies in the South-East Region under the current framework conditions - Section 9.4.

5. Qualitative assessment of the viability of using bioenergy sources for energy production other than those analysed in the case studies - Section 9.5.

The viability analyses were prepared using a tailor-made spreadsheet model for this project.

9.2. Selection & Description of Case Studies

Previous chapters have outlined the following information:

- The regional energy requirements and the current usage of bioenergy in the regional energy balance (Chapter 5)
- The available bioenergy resources in the Region (Chapter 6)
- An overview of which bioenergy supply chains and which bioenergy technologies are available on the market to provide bioenergy services in the heat, electricity and transport sectors (Chapters 7 and 8).

Based on this information and after consideration of the regional conditions, one bioenergy supply chain for each of the three end-use sectors has been selected for further analysis.

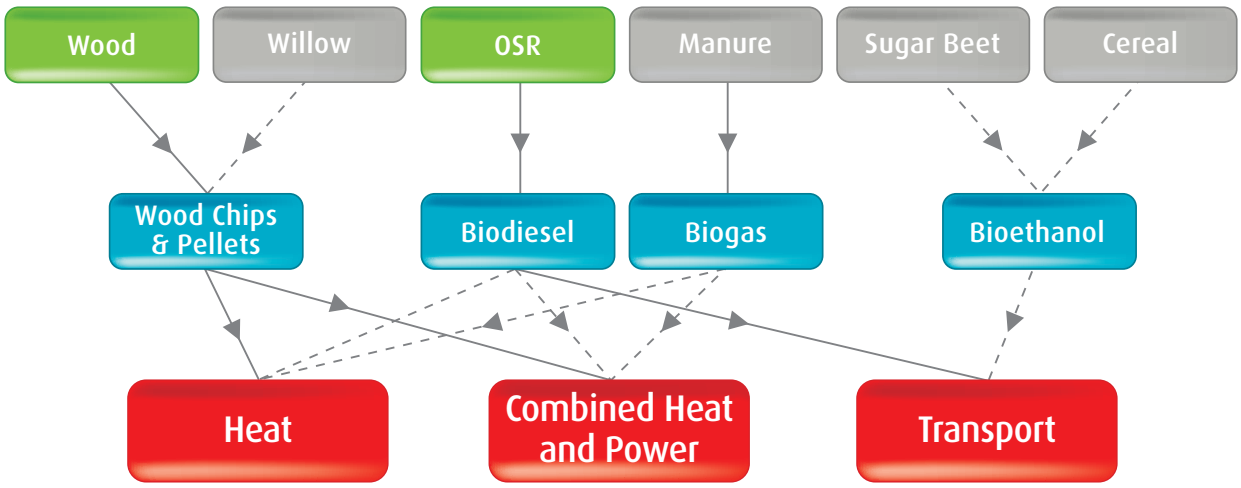
The bioenergy resource assessment in Chapter 6 showed that energy residues from forestry (from first thinnings, later thinnings and final felling) are the most substantial bioenergy resource in the Region. The use of wood fuel was thus significantly considered in the analyses.

Secondly, it was considered constructive that the viability analyses should include one case study covering all three end-use sectors (the heating sector, the electricity sector and the transport sector), since the framework conditions are very different for each sector.

Thirdly, taking into account that no large thermal power plants are currently situated in the Region, it was decided to focus the case study in the electricity sector on the establishment of a CHP-Plant in the Region. Since the extension of district heating is currently rather limited in the Region a case study was developed as an industrial CHP-Plant producing heat for internal needs and selling electricity to the grid.

Figure 9.1 below shows which supply chains were analysed in each case study (marked with green, blue and red), and which supply chains were assessed qualitatively in section 9.5 (marked with grey).

Figure 9.1: Overview of analysed supply chains



In the transport sector the use of oilseed rape for the production of biodiesel seems to be the most realistic biofuel option for use in non-modified engines in the short term, since OSR is produced in the Region and a biodiesel plant is currently under construction in New Ross, Co. Wexford. Bioethanol produced from sugar beet or cereals could be another possibility. In the case that a bioethanol facility is established in the State, the farmers within the Region could be the suppliers of raw material for the bioethanol production. However, since there are no known plans for the establishment of such a plant within the Region itself, bioethanol was not included in the case studies. The South-East Region is also a significant producer of PPO, but this will be used in modified vehicle engines and, therefore, will be tailored towards niche markets.

The selection of the appropriate reference systems was made with regard to the regional energy balance. The most widely used fossil energy sources in the heating, electricity and transport sectors were identified and used in the case studies as reference systems for the economic comparisons.

Table 9.1 below gives an overview of the case studies, including a definition of the alternative systems and the reference systems.

Table 9.1: Overview of Case Studies

Case Study 1: Wood fuel for heat production	**Heat:** Residential wood pellet boiler Commercial wood chip boiler Industrial wood chip boiler	**Heat:** Boilers, based on natural gas and light oil Boilers, based on natural gas and light oil
Case Study 2: Wood fuel for CHP-production	**Electricity:** CHP - steam turbine, using wood chips Electricity production sold to grid	**Electricity:** Buying electricity from grid
	Heat: Heat/steam demand for industrial purposes covered by surplus heat from CHP	**Heat:** Boilers, based on natural gas and light oil
Case Study 3: Biodiesel for transport Fuel: Oil, based on rape seed	**Transport:** Use of biodiesel, blended with conventional diesel at a rate of 5%	**Transport:** Use of conventional diesel

For Case Studies 1 and 2, regarding the use of wood-fuel for heat and CHP production, two different planning situations were analysed:

- Natural replacement of oil or natural gas boilers with bioenergy boilers or CHP-Plants: Investment in a new bioenergy boiler/CHP was compared with investment in a new oil or gas boiler
- Accelerated replacement of oil or natural gas boilers with bioenergy boilers or CHP-Plants: Investment in a new bioenergy boiler/CHP was compared with the continuous use of an existing oil or gas boiler, assuming that no investment is needed in the reference case.

The current energy prices and tariffs were assumed to remain unchanged from 2007 prices (including inflation). For the sensitivity analyses, current energy prices + 25% were assumed to represent a high energy price scenario investigated in Section 9.4.5.

9.3. Requirements for Financial Viability (Pay Back Periods)

It was assumed that the following investor types will be the investors in the analysed bioenergy-technologies:

- Domestic heat boilers: individual households
- Industrial heat boilers: Medium-sized private industries (boiler capacity: 5 MW)
- Industrial CHP-Plants: Medium-sized private industries
- Production of biodiesel: Private industries.

9.3.1. Heating & Electricity Sectors

Experiences worldwide have proven that different investor types have very different requirements for the financial viability of their investments in energy technologies. Energy utilities often consider their investments as long term investments in infrastructure and require a relatively low return on the investment. An accepted pay back period of up to 10 years, and even up to 20-30 years if the investments are considered to be strategic, are common.

Private households on the other hand normally require a high return on their investments in energy technologies, as long as the energy service comfort level is satisfactory. In this case, the alternative investment for households is investing in welfare. This is particularly the case for low income groups that cannot afford to pay more for energy.

The required return on investment depends on a range of other factors, such as:

- The awareness of the technology
- Functionality and appearance of the technology (in the case of replacing an electric stove with a wood pellet boiler, the resident will have to sacrifice space as well as accepting that the heating system may require more effort to operate)
- Trust in the technology
- General attitude to environmental protection
- Access to financing.

In practice it is observed that the majority of households stay with incandescent lamps even if fluorescent lamps have a pay back period of less than 2 years. At the same time, some households invest in solar heating systems with pay back periods of more than 10 years.

In this study it was assumed that an "average" requirement of 6 years of pay back period applied for private households, assuming that the consumers are well informed about the technology, that there is widespread supply of boilers as well as fuel and that specific financing measures have been put in place to reduce the initial financial cost and ensure a positive cash flow from the first year.

Private companies normally require a lower pay back period than 6 years. For energy efficiency measures it is generally found that companies do not accept more than 2-3 years of pay back period. In this analysis, when considering a long-term utility investment, a maximum pay back period of 3 years was assumed.

Based on private investor and industrial investor requirements for the simple pay back (SPB) period, the energy production costs (€/kWh) were calculated for the analysed technologies. The SPB periods and the related energy production costs were used as the key criteria for the comparisons in the viability analyses.

9.3.2. Transport Sector

In the case study for the transport sector, the production of biodiesel from OSR, a slightly different approach was taken.

In this case, the production price, including the purchase of OSR (produced in the Region) and profit, was assessed and compared with the current diesel price (low energy prices) and the diesel price + 25 % (high energy prices).

The viability criterion for this analysis was based on whether the biodiesel production costs, with and without mineral oil tax, were comparable with the price of fossil diesel with mineral oil tax included.

9.4. Results of the Viability Analyses

In the following sections, the requirements of investors with regard to the pay back period are compared with the calculated pay back periods for each of the analysed replacements of oil/gas boilers with biomass boilers/CHP-Plants. In addition, the related energy production costs are shown. Both planning situations ("Natural replacement" and "Accelerated replacement") are shown. The assumption made with regard to developing the Viability Analyses are presented in Appendix 2.

The current energy prices were assumed to remain unchanged for the next 20 years (low energy price scenario). Finally, the fuel price sensitivity was discussed.

9.4.1. Individual Heat Boilers

A 20 kW individual wood pellet boiler was compared with an oil boiler and a natural gas boiler as reference systems.

The investment cost of a pellet boiler without subsidy was estimated to be approximately €11,300, while the price after receiving investment subsidy was calculated to be € 6,300 approx.

No energy tax or CO_2 tax is currently imposed on fossil fuels. This means that the current price level for wood pellets in terms of fuel price per energy unit is similar to or higher than natural gas and oil.

Table 9.2: Economic Calculations for Case Study 1, Individual Heat Boilers

	Reference System				Alternative System Domestic Pellet Boiler			SPB	Maximum Expected Pay Back Period
	Technology	Investment cost 1000 €	O&M cost 1000 €/year	Production cost €/kWh	Investment cost incl. subsidy 1000€	O&M cost 1000 €/year	Production cost €/kWh	Years	Years
Natural Replace-ment	Natural gas boiler	8.470	1.42	0.142	6.292	1.82	0.143	N/A	6
	Oil boiler	9.680	2.13	0.187	6.292	1.82	0.143	N/A	6
Acc. Replace-ment	Natural gas boiler	0.0	1.42	0.061	6.292	1.82	0.143	N/A	6
	Oil boiler	0.0	2.13	0.074	6.292	1.82	0.143	97	6

The conclusions from the viability analysis of an individual biomass boiler run on wood pellets are as follows:

- The investment in a pellet boiler is lower than the investments in a natural gas boiler or an oil boiler. On the other hand, the operation and maintenance costs (including fuel costs) for the combustion of pellets are higher than the price for combustion of natural gas, but lower than those of an oil fired boiler.
- Natural replacement of oil boilers with wood pellet boilers was found to be viable, while the production costs of heat are about the same in a natural gas boiler as in a wood pellet boiler.
- Accelerated replacement is not viable.

It should be noted that this viability analysis was particularly sensitive to the level of investment subsidy, the annual full-load hours of the boiler (the utilisation of the capacity), as well as the difference in fuel costs between conventional fuel and wood pellets.

9.4.2. Commercial Heat Boilers

In an attempt to represent the market segment of biomass boilers in commercial buildings, small industry and institutions, a comparison was made between a 100 kW wood chip boiler and a conventional natural gas boiler or an oil fired boiler. The findings are shown below:

Table 9.3: Economic Calculations for Case Study 1, Commercial Wood Chip Heat Boilers

	Reference System				Alternative System Commercial Wood Chip Boiler			SPB	Maximum Expected Pay Back Period
	Technology	Investment cost 1000 €	O&M cost 1000 €/year	Production cost €/kWh	Investment cost incl. subsidy 1000€	O&M cost 1000 €/year	Production cost €/kWh	Years	Years
Natural Replace-ment	Natural gas boiler	42.400	10.2	0.107	47.400	6.0	0.093	0.38	6
	Oil boiler	42.400	14.0	0.128	47.400	6.0	0.093	0.33	6
Acc. Replace-ment	Natural gas boiler	0.0	10.2	0.054	47.400	6.0	0.093	3.5	6
	Oil boiler	0.0	14.0	0.065	47.400	6.0	0.093	3.1	6

The conclusions from the viability analysis of a commercial wood-chip boiler are as follows:

- Total production costs of heat in the wood chip boiler are less than the production costs using natural gas or oil. The additional investment after subsidy (44%) is not very significant and, as a result, the simple pay-back period is less than one year in the case of natural replacement
- Even in the case of forced replacement the viability of the project is better than the minimum criteria of no more than 6 years of pay-back period
- The analysis found that the installation of wood-chip fired heating systems is an attractive option for the commercial/industrial sector.

9.4.3. Industrial Heat Boilers

A 5 MW industrial wood chip boiler and an industrial wood pellet boiler of the same size were compared with an oil boiler and a natural gas boiler as reference systems (four comparisons in total).

The investment in the wood fired boiler without subsidy was estimated to be approx. €2.8m, while the price after receiving investment subsidy was calculated as €2.2m, corresponding to a 21% investment subsidy (30% for the first MW installed capacity and 20% for the remaining MW installed up to a maximum eligible cost of €750,000 under the ReHeat Programme).

The viability analyses are presented in Table 9.4 and the following conclusions were reached:

- The investment in a wood pellet boiler or a wood chip boiler is approx. 25% higher than the investments in a natural gas or an oil-fired boiler. However, the operation and maintenance costs for a wood fuel boiler are substantially lower than the corresponding price for natural gas and oil boilers, ranging from 28% lower (wood pellet boiler compared with natural gas boiler) to 55% lower (wood chip boiler compared with oil boiler)
- Natural replacement was found to be viable in all four comparisons, ranging from a simple pay back period of 6 months (replacement of an oil boiler with a wood-chip fired boiler) to 1.5 years (replacement of a gas boiler with a wood-pellet fired boiler)
- Accelerated replacement of oil and gas boilers with a wood pellet boiler was not viable according to the criterion (3 years pay back period). However, it should be noted that the pay back period for replacement of an oil boiler with a wood pellet boiler is only 3.5 years
- Accelerated replacement of an oil boiler with a wood chip boiler is viable with a pay back period of 2.4 years
- Accelerated replacement of a natural gas boiler with a wood chip boiler is close to being viable with a pay back period of 3.6 years
- Bioenergy based heating systems were found to be an attractive option for larger industries in the South-East Region.

9.4.4. Industrial CHP-Plants

An industrial wood chip fired CHP-Plant (5 MW_{th}) was compared with an oil boiler and a natural gas boiler as the reference heat system. The electricity produced by the CHP-Plant can be sold to the national grid under the REFIT scheme for 7.2 Eurocents/kWh.

Table 9.4: Economic Calculations for Case Study 1, Industrial Boiler

		Reference Industrial Boiler			Alternative Industrial Boiler					SPB Wood Chips	SPB Pellets	Investor Requirements
	Technology	Investment cost 10^3€	O&M cost 10^3€/ year	Production cost €/kWh	Investment cost 10^3€	O&M cost W. chips 10^3€/ year	O&M cost Pellets 10^3€/ year	Production cost W. chips €/kWh	Production cost W. chips €/kWh	Years	Years	Years
Natural Replace-ment	Natural gas boiler	1,750	1,322.720	0.068	2,187.5	729.199	1,030.900	0.048	0.058	0.7	1.5	3
	Oil boiler	1,750	1,645.117	0.078	2,178.5	729.199	1,030.900	0.048	0.058	0.5	0.7	3
Acc. Replace-ment	Natural gas boiler	0	1,322.720	0.044	2,178.5	729.199	1,030.900	0.048	0.058	3.6	7.2	3
	Oil boiler	0	1,645.117	0.055	2,178.5	729.199	1,030.900	0.048	0.058	2.4	3.5	3

Table 9.5: Economic Calculations for Case Study 2, Industrial CHP-Plant

		Reference Industrial Boiler			Alternative Industrial Boiler					SPB Wood Chips	SPB Pellets	Investor Requirements
	Technology	Investment cost 10^3€	O&M cost 10^3€/ year	Production cost €/kWh	Investment cost 10^3€	O&M cost W. chips 10^3€/ year	O&M cost Pellets 10^3€/ year	Production cost W. chips €/kWh	Production cost W. chips €/kWh	Years	Years	Years
Natural Replace-ment	Natural gas boiler	1,750	1,322.720	0.068	5,906	368.252	775.547	0.078	0.086	3.6	4.1	3
	Oil boiler	1,750	1,645.117	0.078	5,906	368.252	775.547	0.078	0.086	2.5	3.0	3
Acc. Replace-ment	Natural gas boiler	0	1,322.720	0.044	5,906	368.252	775.547	0.078	0.086	4.7	5.8	3
	Oil boiler	0	1,645.117	0.055	5,906	368.252	775.547	0.078	0.086	3.5	4.0	3

The investment costs for a wood chip based CHP turbine (5 MW_{th}) without subsidy was estimated to be approximately €8.5m, while the price after investment subsidy is €5.1m, corresponding to approximately a 35% investment subsidy. This subsidy will shortly be launched under the SEI biomass-based CHP Scheme.

The viability analyses for the installation of a 5MW industrial CHP-Plant in the South-East Region are presented in Table 9.5 and the following conclusions were reached:

- The investment in the wood chip fired CHP-Plant is more than 3 times higher than the investments in a natural gas or oil-fired boiler. However, the total operation and maintenance costs (O&M costs) of wood pellets are approx. half the cost for natural gas and oil boilers, and the O&M costs of wood chips are only approx 25% of the O&M costs for oil and gas boilers
- Natural replacement of an oil and gas boiler with the wood pellet fired CHP-Plant was not viable
- Natural replacement of the oil boiler with a wood chip fired CHP-Plant was found to be viable with a simple pay back period of 2.5 years
- Natural replacement of a gas boiler with a wood chip fired CHP-Plant was close to being viable with a simple pay back period of 3.3 years
- Accelerated replacement of oil and gas boilers with CHP-Plants, based on wood fuel, was not viable.

9.4.5. High Energy Price Scenario

Table 9.6: Energy Production Costs, High Energy Prices

		Reference System		Alternative Systems	
		Low energy prices	High energy prices	Low and high energy prices	
		Production costs €/kWh	Production costs €/kWh	Production costs €/kWh	Production costs €/kWh
	Fuel			**Wood chip**	**Wood pellets**
	Individual Boilers				
Natural Replace-ment	Natural gas	0.102	0.113	N/A	0.095
	Oil	0.133	0.147	N/A	0.095
Acc. Replace-ment	Natural gas	0.049	0.061	N/A	0.095
	Oil	0.059	0.074	N/A	0.095
	Industrial Boilers				
Natural Replace-ment	Natural gas	0.068	0.078	0.048	0.058
	Oil	0.078	0.092	0.048	0.058
Acc. Replace-ment	Natural gas	0.044	0.054	0.048	0.058
	Oil	0.055	0.068	0.048	0.058
	Industrial CHP-Plants				
Natural Replace-ment	Natural gas	0.068	0.078	0.078	0.086
	Oil	0.078	0.092	0.078	0.086
Acc. Replace-ment	Natural gas	0.044	0.054	0.078	0.086
	Oil	0.055	0.068	0.078	0.086

Table 9.6 presents the situation whereby current energy prices increase by 25% and re-assesses the bioenergy based systems for their viability in the South-East Region in a high energy price scenario. The table shows that an increased energy price level for fossil fuels, with few exceptions, does not change the conclusions made in the previous sections.

9.4.6. Biodiesel in the Transport Sector

As biodiesel is currently not manufactured in the South-East Region, an estimate of the manufacturing and production price of biodiesel has been made. The estimation is based on information from Danish studies on biodiesel production ([40]) and on estimates of the biodiesel production costs in the South-East Region.

The Irish market price for OSR was added to the estimated manufacturing cost, which resulted in a total estimated production cost. Within the manufacturing cost, it is assumed that the co-products (glycerine and rape cake) are valuable products on the market. The profit on biodiesel production is assumed to be 25% of the production cost.

Figure 9.2 illustrates the market price level for biodiesel compared with conventional diesel. Mineral oil tax (MOT) is included in the diesel cost and biodiesel (i.e. Rape-Methyl-Ester [RME]) is shown both with and without MOT. The price for conventional diesel is shown for both the low and high energy price scenarios.

Figure 9.2: Production Cost and Market Price for Biodiesel (RME) and Conventional Diesel

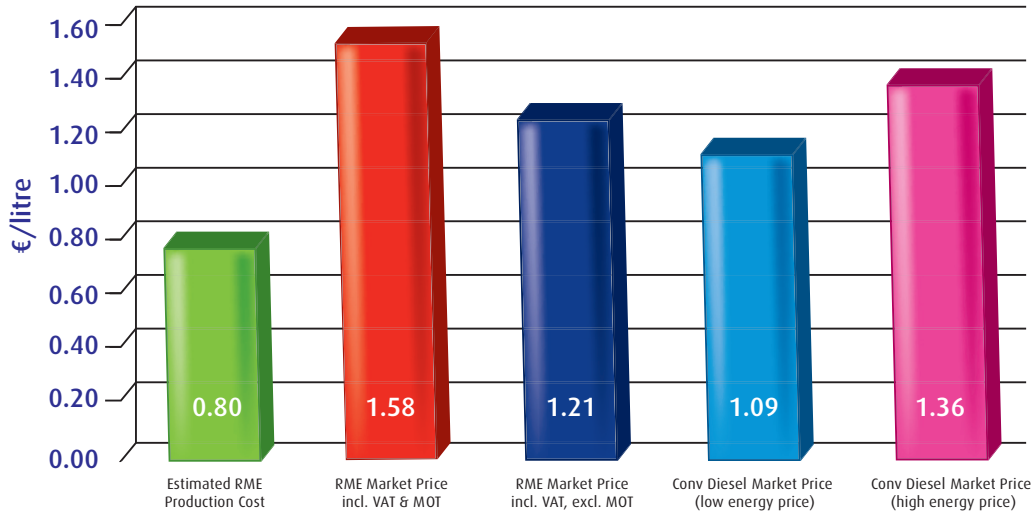


Figure 9.2 shows:

- The market price including VAT and MOT for biodiesel based on OSR has a price level that is quite high in comparison to conventional diesel, at both the low and high energy price scenarios
- The biodiesel which is currently exempted from MOT (under the current MOTR Scheme) has a price which is comparable to conventional diesel costs and will be increasingly competitive with any increase in the cost of conventional diesel
- It is expected that RME production costs will decrease with increased levels of production and the use of recovered vegetable oil (RVO) and tallow (animal fats) as feedstock for biodiesel production, which will decrease the market price of RME to make it comparable with conventional diesel
- Once the current MOTR scheme is complete the possibility of applying MOT to biofuels will be reviewed by the Government and other options for encouraging the indigenous production of biofuels will be considered.

9.5. Qualitative Assessments of other Bioenergy Sources

The following other bioenergy resources are discussed below:

- Willow for wood fuel production
- Agricultural slurry for biogas production
- Sugar beet and cereal for bioethanol production
- Surplus straw from agriculture.

9.5.1. Willow for Wood Fuel Production

Willow is a rather new type of wood fuel on the market, and market price trends have not yet been established. A sale price for one producer of wood pellets and wood chips, based on willow, indicates significantly higher prices than similar prices for pellets and wood chips from sawmills and from forestry. However, these prices do not take into account the BioEnergy Scheme, which provides establishment grants to encourage the growing of willow and miscanthus for the production of biomass suitable for use as a renewable source of energy.

Conclusion: As a basis for the target setting for the penetration of willow on the energy market it is assumed that wood chips, produced from willow, will follow the same prices as wood chips and wood pellets produced from other types of wood.

9.5.2. Agricultural Slurry for Biogas Production

Agricultural slurry, apart from a few and small exceptions on farms, is not widely used in the South-East Region for energy production.

The following issues are central when assessing the viability of biogas-produced energy on the market:

- The framework conditions provided by the State
- Access to alternative organic material such as waste from slaughterhouses and dairies etc.
- Possibilities to utilise surplus heat from the gas motors
- Energy price development for fossil fuels.

The framework conditions for the production of electricity and heat from biogas are the following:

- Up to 35% investment subsidy is expected to the grant support for the CHP part of the biogas plant (the biogas motor)
- REFIT tariff for electricity, generated from biomass, is assumed to be 7.2 Eurocents/kWh.
- Sale of heat has to compete with heat, produced from fossil fuels without energy tax.

The gas motor accounts for approx. 25% of the total investment in a biogas plant, corresponding to an investment subsidy of approx. 10% in total. In Denmark a demonstration program for the establishment of biogas plants (biogas plants on farms as well as centralised biogas plants) was undertaken during the 1990s, which included a 30% investment subsidy, a buy-back rate of electricity of approximately 8 Eurocents/kWh and a heat tariff corresponding to taxed fossil fuels. These conditions resulted in the establishment of approx. 25 centralised biogas plants, selling electricity to the national grid and surplus heat to 1-day district heating networks. In 2001, the investment subsidy was cancelled and a liberalisation of the electricity market also resulted in lower electricity prices than 8 Eurocents/kWh. Since then no centralised biogas plants and only a few farm-based biogas

plants have been established. Currently, the framework conditions for biogas utilisation in Denmark are being negotiated in the Danish Parliament. It is expected that the framework conditions will be improved substantially in order to restart the Danish establishment of biogas plants.

An isolated comparison of the current Irish framework conditions with the Danish conditions shows that the Irish framework conditions for the utilisation of biogas are less attractive than the Danish framework conditions during the 1990s.

Access to alternative organic material (the amounts and the prices involved) and the possibilities for utilising surplus heat from the biogas motors are other crucial factors, which depend on local conditions. Organic material is most likely available on the market, but the conditions are not known, since no market price for these products has been established. Large scale sale of surplus heat seems difficult to obtain, since district heating is not currently taking place in the Region. In the case of farm-based biogas plants, the surplus heat from the motors can be utilised as an input to the biogas process and, to some extent, to deliver heat to the farm in question.

Conclusion: As a basis for the target setting for the penetration of biogas to the regional energy market it is assumed that biogas utilisation is not viable under the current conditions.

9.5.3. Sugar Beet and Cereals for Bioethanol Production

Sugar beet and cereals can be used for bioethanol production. Bioethanol can be blended with petrol and used as a transport fuel, as described in Chapter 8. If bioethanol is to compete on the market, the production price plus overhead margin for bioethanol needs to be comparable to the retail price for petrol, including MOT.

The retail price for petrol (28 June 2007) is €1.173/litre, of which MOT is €0.44/litre. Recent information from the EU Commission indicates that the current European market price (July 2007) for bioethanol is €0.75/litre.

By applying the international market price, bioethanol is competitive with the retail petrol price, provided bioethanol is granted MOT exemption. If tax exemption is not granted, the bioethanol price (€0.75 + €0.44 = 1.19 €/litre) will be at the same level as the current retail price for petrol (1.173 Euro/litre). Without tax exemption, bioethanol will only be introduced on the market, if mandatory measures are being used.

However, Ireland needs to comply with the EU Biofuels Directive, which requires that 5.75% of all petrol and diesel needs to be biofuel in all member states before 31 December 2010. It is unlikely that all of this biofuel can be provided in the form of biodiesel. It is assumed, therefore, that suitable financial incentives or other regulation will be put in place within the near future to improve the competitiveness of bioethanol.

Conclusion: As a basis for target setting for the penetration of bioethanol to the transport fuel market, it is assumed that bioethanol penetration will follow the EU Biofuels Directive targets.

9.5.4. Surplus Straw from Agriculture

Straw, which is produced as a dry residue of the agricultural sector, can be combusted to produce heat and electricity. However, there are already a number of alternative uses for the straw produced within the Region, including animal bedding, compost production and its re-incorporation into soil as a fertiliser. Studies have estimated that approximately 14% of this resource is available for energy generation.

9.6. Summary of the Bioenergy Potential of the South-East Region

Table 9.7 summarises the conclusions and assumptions regarding the bioenergy resource availability in the Region:

Table 9.7: Resource Availability

Bioenergy Source	Current Use Note 2 (TJ/Year)	Resources Available (TJ/Year)	Current Biomass Use as % of Resource Availability
Wood-chips / wood-pellets from forestry and sawmills Note 1	857	1,215 (Table 6.2)	25
Woodchips from willow	0	6704 (Tables 6.7/ 6.14)	0
Surplus straw from agriculture	0	1089 (Table 6.3)	0
Biodiesel/PPO from OSR	15 Note 3	452 (Table 6.6)	0
Biogas from pig slurry and cattle slurry	0	406 (Table 6.4/ 6.5)	0
Biogas from grass	0	330 (Table 6.9)	0
Bioethanol from sugar beet	0	709 (Table 6.13)	0

Note 1: The current use of wood fuel is mainly wood chips and wood pellets delivered from forestry (wood chip) and sawmills (wood pellets). However, the figure for resource availability (1,215 TJ) is only based on resource assessments within forestry.
Note 2: Estimated regional energy use for 2006
Note 3: Total estimated energy from biofuels for the Region for 2006

When combining the Region's resources with the financial analyses of the relevant technologies, it is possible to identify areas where there is a realistic potential for increased bioenergy utilisation in the South-East Region. For market viability the following conditions must exist: demand, supply and a proven viable technology.

9.6.1. Wood Chips

The viability analysis suggests an attractive viability within the South-East for medium to large-scale wood chip boilers with extensive operation hours per year (circa 7,800-8,000 per annum). Furthermore, wood chip based CHP-Plants are viable with a suitable number of operation hours per year.

The fuel demand in the industrial sector is almost equivalent to the total wood resource including willow. However, a certain fraction of the demand goes to small scale boilers and boilers with less operation hours. No detailed statistics are available with regard to the distribution of the fuel consumption on boiler sizes and operation hours.

In the absence of more detailed data it was assumed that 25% of the fossil fuel consumption takes place in boilers where accelerated replacement would be financially viable; while another 25% takes place in boilers where only natural replacement would be viable. It was further assumed that the average lifetime of a fossil fuel boiler is 25 years, suggesting that 4% of boilers are replaced annually.

The viability analysis suggested that a certain fraction of this potential could be in the form of CHP, but that the actual share of CHP would depend on a range of non-economic factors which have not been analysed in this study.

Furthermore, it was assumed that 25% of fuel consumption in the agricultural sector could be substituted by wood at natural replacement of boilers.

9.6.2. Wood Pellets

The existing incentive programme for the replacement of domestic fossil fuel boilers with wood boilers has stimulated a strong interest in this technology, supporting the findings of the viability analysis that heat production costs using wood pellets are lower than those of natural gas and oil.

The international market price for wood pellets has seen an increase over the last few years, and the future viability of the wood pellet boiler technology is less certain.

9.6.3. Biodiesel

The viability analysis shows a good potential for biodiesel in the South-East Region. It was assumed, therefore, that the total of the resource potential (452 TJ/year) will be utilised. It is assumed that the diesel demand is sufficient to accommodate the biodiesel produced locally, if a blending rate of up to 5.75% is allowed.

9.6.4. Bioethanol

Although bioethanol production is as viable as biodiesel according to the viability assessments, there are no plans for the production of bioethanol within the South-East Region.

However, the harvesting and supply of cereals or sugar beet for bioethanol production could be a viable option should a bioethanol plant be established in the Region or within an acceptable transport distance outside the Region.

9.6.5. Pure Plant Oil

There is strong potential for the production of PPO in the South-East Region and two producers within the Region were awarded MOT relief under the Government MOTR scheme. This move is expected to produce 14 million litres of PPO by the end of 2010 for use in modified vehicle engines.

10. BARRIER ASSESSMENT

Despite a large amount of recent renewable energy policies published at government level and a raised awareness of the availability of bioenergy technologies, there are still a number of barriers facing any prospective development of a bioenergy project in the South-East Region. During the course of developing this Implementation Plan, and particularly during the stakeholder consultation process, a number of barriers to development were identified. Some of these barriers are common across all the sectors and some are specific to the particular markets of heat, electricity and transport. These barriers are discussed below.

The financial analyses discussed in Chapter 9 suggest that bioenergy is a viable alternative for energy generation in households, industries and as transport biofuels. The relevant technologies are available in the Region with a sufficient degree of stability and reliability.

Thus, there are a number of barriers to development which can be addressed by the local and regional authorities to encourage the increased uptake of bioenergy in the South-East.

10.1. General Barriers for the Bioenergy Sector as a Whole

The main barriers to the successful development of the bioenergy sector in the South-East Region are:

- Lack of information/understanding and public awareness
- Lack of understanding of the long-term implications of national policies
- Fuel chain barriers
- Need for additional financial incentives.

10.1.1. Information and Awareness

The successful implementation of the Plan requires an increased level of awareness among stakeholders, including energy consumers, technology providers and fuel suppliers.

Interest in renewable energy technologies has grown significantly in recent years due to rising energy prices, high profile advertising campaigns and strong promotion of schemes such as the SEI Greener Homes Scheme and the ReHeat Scheme. However, the public as well as consumers in the commercial and industrial sectors need to be made aware of the benefits of switching to bioenergy systems to meet their energy needs and of which systems are the most appropriate.

10.1.2. Policy and Implementation

One of the main issues for developers and for prospective investors in bioenergy projects is the perceived lack of consistency and transparency among public agencies on the treatment of bioenergy. Feedback from the Stakeholder Consultation Forum was that it is difficult to obtain guidance on the planning issues surrounding a bioenergy development. One of the objectives of this Implementation Plan is to promote bioenergy at a regional level and to achieve a co-ordinated approach to the implementation of bioenergy policies across the South-East Region.

10.1.3. Fuel Chain Barriers

In order for bioenergy to be considered attractive, there must be secure fuel chains available, ensuring a secure supply and stable prices. Such fuel supply chains are not fully in place in the South-East Region.

However, incentive schemes at national level to encourage the production of raw materials such as the energy crop top-up payment and the Bioenergy Scheme are encouraging the agricultural community to play a role in the provision of raw materials. The promotion of these schemes in the South-East Region will ensure that regional supply chains will strengthen.

10.1.4. Need for Additional Financial Incentives

The regional and local authorities in the South-East can provide valuable feedback to the relevant national agencies regarding the need for financial incentives in order to achieve the national targets. For instance, there is a need for financial support to promote the installation of biomass-based CHP-Plants. SEI will shortly launch a grant programme to support these projects and the success of this scheme in the Region will be monitored and reported to SEI.

10.2. Specific Barriers within the Heat Sector

The use of bioenergy as a fuel within the heating sector is advancing strongly, due particularly to the success of the Greener Homes Scheme, administered by SEI on behalf of the Government. There has been a large uptake of the grants available and the installation of biomass boilers account for almost 50% of the grant applications.

There are still a number of barriers facing the development of this sector, such as:

- Capital cost of equipment
- Lack of public information and awareness
- Fuel supply chain lacking
- Fully trained installers needed
- Competing with fossil fuel prices
- Standards needed – quality assurance for boilers and for fuel.

10.2.1. Capital Cost of Equipment

For domestic consumers and small commercial enterprises the capital cost of switching over to biomass heating technology can still be a significant barrier. The capital costs for bioenergy projects are usually higher than for conventional systems based on fossils fuels, due to the fact that the technologies involved are relatively new. However, the various Grant Schemes in place have gone some way to alleviating this barrier. Under the Greener Homes Scheme, introduced in 2006, domestic consumers can now apply for grant assistance towards the capital cost of investing in renewable energy heat technologies, including biomass boilers and stoves.

10.2.2. Fuel Supply Chains

The reliability of wood fuel supply chains and competition for the resource within the wood processing industry have been identified as potential issues in the Region. In order to capture the environmental benefits of wood as a renewable energy source, the source of the wood fuel and the final end-users should ideally be located close to one

another. The successful implementation of this Plan will stimulate an increased demand for wood fuel in the South-East Region, which could require the importing of wood for energy from other Irish regions or from the rest of Europe. The strengthening of indigenous wood supply chains and stimulating the growth of SRC willow should be prioritised in the Region to contribute to the development of a sustainable wood chip/pellet industry.

10.2.3. Information and Awareness

There is a perceived lack of accurate information and awareness across both the public and private sectors and the general public with regard to the bioenergy technologies and the financial assistance available. This barrier will be influenced by consistent and coherent energy awareness campaigns and by publicising this Implementation Plan to all relevant stakeholders.

10.2.4. Quality Assurance

Quality assurance of the bioenergy technologies and of the wood fuel supply is likely to be an issue which will need to be addressed immediately. In the past few years there has been considerable growth in the industry with a large number of new producers, suppliers and installers entering the market. In order to ensure that the market grows in a sustainable manner and that consumer confidence is maintained, quality assurance for the sector will be essential.

10.2.5. Training Needs

In addition, there is a need to train and increase the knowledge and skills base of technicians for the installation and maintenance of the new bioenergy technologies. This barrier has been identified by the Government in the Bioenergy Action Plan for Ireland ([14]) and SEI is currently developing a course with FÁS, the National Training and Employment Authority, to ensure that there is a nationwide network of fully trained installers in order to meet with the increasing market demand. Architects and structural designers are also an important target audience for training.

10.3. Specific Barriers within the Electricity Sector

The deployment of bioenergy in the electricity sector is probably the least developed area in the South-East Region.

Biomass-fired CHP technology is the most developed and with the upcoming launch of the SEI Biomass CHP Deployment Scheme, the uptake of this technology in the South-East Region will be the future for bioenergy-generated electricity.

The main barriers for this sector are:

- Grid connection availability, costs of grid connection, technical availability for connection
- Pricing of electricity sold to the grid.

The regional and local authorities in the South-East can provide feedback to the national agencies regarding the need for financial incentives.

10.4. Specific Barriers within the Transport Sector

The transport sector, particularly road transport, is one of the largest consumers of energy in Ireland and in the South-East Region. This sector is one of the most vulnerable to energy price changes, as is evident from the increasing cost of

petrol and diesel, and it has far-reaching effects on all industries.

The Government has set ambitious targets for the penetration of biofuels into the market by 2010, but in order to reach these targets there are a number of barriers that must be overcome or alleviated, such as:

- Biofuel supply chain needs to be strengthened
- Excise programme too small, some developers excluded
- Quality assurance measures
- Planning matters – consistency needed across the Region
- Public awareness.

10.4.1. Supply Chains

The supply of bioethanol, biodiesel and pure plant oil is still in the very early stages of development in Ireland. A small number of forecourts throughout the country are now selling bioethanol E85, but biodiesel is not currently available. However, the Government's MOTR scheme, as discussed in Chapter 3, aims to place 164 million litres of biofuels on the market by 2008. This scheme has stimulated development in the biofuels sector and it is essential that the supply chains are strengthened in order to maintain development and to ensure investor confidence in a fledgling industry.

10.4.2. MOTR Scheme

There are concerns that the MOTR scheme which was restricted to 16 applicants, as listed in Chapter 3, was inhibiting competition in the market. However, the scheme is only a temporary solution to encourage development of the market and it is hoped that the market will develop further as the demand for biofuels increases. The Government has committed to introducing an obligation scheme which will oblige fuel distributors to achieve an average of 5.75% biofuels (on an energy basis) of their total annual quantity of fuel placed on the market by 2009. Any action at a national level will be closely monitored for its relevance to the South-East Region.

10.5. Addressing the Barriers

The barriers listed and discussed in this Chapter were all taken into account in the development of the Bioenergy Implementation Plan, as outlined in Chapter 13. The action items recommended in the Plan aim to alleviate and overcome the barriers facing the bioenergy industry in the South-East.

11. STATUTORY REQUIREMENTS FOR BIOENERGY DEVELOPMENTS

11.1. Introduction

This section identifies the primary legislation that would have to be considered by a developer prior to the commencement of any bioenergy project. The statutory obligations pertaining to any project will specifically be related to the nature and scale of the proposed development.

In determining the statutory requirements that a proposed project should adhere to, the development of the project should be assessed under the following phases:

- Pre-development
- Facility operation
- By-product management/utilisation.

11.2. Statutory Requirements

11.2.1. Compliance with the County/City Development Plans

Development Plans identify development zoning areas and development objectives for their functional areas. Most development plans have given some consideration to the promotion of the development of the bioenergy sector. In some instances specific development objectives for the promotion of the bioenergy sector are contained within the policy section on renewable energy.

An assessment was undertaken to identify the specific development policies within the South-East Region to support the bioenergy sector. The development objectives/policies contained within the current County/City Development Plans are outlined in Appendix 4.

Applicants/promoters seeking development consent to establish a bioenergy facility should in their application to the Planning Authority demonstrate the compatibility of their proposed development with the zoning and policy objectives of the relevant Development Plan.

11.2.2. Planning Consent

For the most part, all infrastructural developments require planning permission and some are subject to an Environmental Impact Assessment (EIA) depending on their nature, scale and potential environmental impacts. An exception is made if a proposed development is considered an "Exempted Development". Schedule 2 of S.I. No. 600 of 2001, Planning and Development Regulations lists exempted development activities together with the conditions and limitations that must prevail for the proposed development to be considered "Exempted".

11.2.3. Environmental Impact Assessment

Proposed developments requiring an EIA are listed under Schedule 5 of S.I. No. 600 of 2001, Planning and Development Regulations. If a proposed development does not exceed the threshold values set out in Schedule 5, but the Local Authority in whose functional area the proposed development is to be located considers that the proposed development may pose a significant environmental threat, then an EIA can be requested to accompany the planning application.

An EIA is a systematic approach that examines, in advance of development actions, their environmental consequences. Baseline conditions are recorded and then compared with the predicted conditions arising from the proposed development. Any differences between baseline conditions and the predicted conditions are described in terms of their potential impact on the environment. Screening is the process that determines if a project is subject to an EIA, while scoping focuses on the aspects of the project that need to be addressed.

The information to be included in an Environmental Impact Statement (EIS) is defined in Schedule 6 of the Planning and Development Regulations, 2001.

The following information must be included in the EIS:

1. (a) A description of the proposed development comprising information on the site, design and size of the proposed development.

   (b) A description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects.

   (c) The data required to identify and assess the main effects which the proposed development is likely to have on the environment.

   (d) An outline of the main alternatives studied by the developer and an indication of the main reasons for his or her choice, taking into account the effects on the environment.

2. Further information, by way of explanation or amplification of the information referred to in Paragraph 1 on the following matters:
   (a) (i) a description of the physical characteristics of the whole proposed development and the land-use requirements during the construction and operational phases.
   (ii) a description of the main characteristics of the production processes, for instance, nature and quantity of the materials used.
   (iii) an estimate, by type and quantity, of expected residues and emissions (including water, air and soil pollution, noise, vibration, light, heat and radiation) resulting from the operation of the proposed development.

   (b) a description of the aspects of the environment likely to be significantly affected by the proposed development, including:
   - human beings, fauna and flora
   - soil, water, air, climatic factors and the landscape
   - material assets, including the architectural and archaeological heritage, and the cultural heritage
   - the inter-relationship between the above factors.

(c) a description of the likely significant effects (including direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative) of the proposed development on the environment resulting from:

- the existence of the proposed development
- the use of natural resources
- the emission of pollutants, the creation of nuisances and the elimination of waste.

and a description of the forecasting methods used to assess the effects on the environment.

(d) an indication of any difficulties (technical deficiencies or lack of know-how) encountered by the developer in compiling the required information.

The EIS must be prepared in accordance with guidelines provided by the Environmental Protection Agency (EPA):

(a) Advice note on Current Practice (in the preparation of EIS)
(b) Guidelines on the Information to be contained in the EIS.

The planning application accompanied by an EIS would be required to be submitted to the planning department of the Local Authority in whose functional area the proposed development is to be located.

11.3. Environmental Protection Agency

Depending on the type, nature and scale of a proposed development the consent of the EPA may be required. The EPA administers two licensing systems – Integrated Pollution Prevention and Control (IPPC) Licence and Waste Licence. The requirement for a proposed development to obtain either an IPPC or waste licence is defined in the following Acts:

11.3.1. Waste Licence Application

The Waste Management Acts, 1996 to 2005 stipulate that a licence must be obtained from the EPA before a waste management facility can be operated. This requirement is outlined in the Waste Management Act, 1996, Section 39 (1) and (3) (as amended by S.I. No. 116 of 1998, Article 4B).

Bioenergy projects utilising a biomass considered to be a waste will require either a waste licence or a waste permit. Waste Permits are issued by local authorities. The requirement for a waste permit will depend on the quantity of biomass to be used as a feedstock and whether or not the bioenergy activity is considered a “recovery” or “disposal” activity.

An example of a bioenergy project which could be subject to either a waste licence or permit is the operation of an aerobic digestion facility or a CHP facility using woodchip discarded from a sawmilling process.

11.3.2. IPPC Licence Application

The Environmental Protection Act, 1992 as amended by the Protection of the Environment Act, 2003 stipulates activities that require IPPC licences in order to operate.

Example of activities requiring IPPC licences are the large scale production of electricity or the production of biofuels.

Each proposed project should be evaluated and assessed based on its type, nature and scale when determining if consent is required from the EPA prior to development/operation.

11.4. Electricity Generation Authorisation and Licences

If the purpose of a proposed project is the generation of electricity from biomass for sale to the grid, then the applicability of the following should be considered during the project conception phase:

Under the Electricity Regulation Act, 1999, the Commission for Energy Regulation (CER) licenses new entrants to the electricity generation and supply market. The following are the different types of licence which may apply:

11.4.1. Authorisation to Construct

Anyone wishing to construct a new generating station or reconstruct an existing generating station must obtain an Authorisation to Construct under Section 16 of the Act.

11.4.2. Licence to Generate Electricity

Under Section 14 (1) (a) of the Act the Commission has powers to grant, or refuse to grant, a Licence to Generate Electricity.

11.4.3. Licence to Supply Electricity

There are two classes of Licence to Supply Electricity which the Commission has powers to grant, or refuse to grant:

- Licence to supply eligible customers, under Section 14 (1) (b) of the Act
- Licence to supply all final customers with electricity produced from "green" sources, under Section 14 (1) (c) of the Act.

11.5. Animal By-Products Regulations

In the case of a proposed facility such as an anaerobic digestion plant intending to use the organic fraction of MSW as a biomass feedstock the provision of the Regulation (EC) 1774/2002 of the European Parliament and of the Council laying down health rules concerning animal by-product not intended for human consumption (ABP Regulation) would be applicable.

Any facility accepting waste types classified as either Category 1, 2 or 3 wastes in accordance with this Regulation is subject to the requirements of the regulation.

Examples of these waste types include:

- Waste collected from slaughtering facilities
- Catering waste from means of transport operating internationally, e.g. Dublin Airport or Dublin Port
- Catering wastes.

The key objective of this Regulation is to prohibit the recycling of certain animal by-products into the food chain. Furthermore, it:

- Introduces a number of alternative methods for the disposal of animal by-products
- Strengthens the rules on controls and traceability of animal by-products
- Establishes a link with Environmental Community Legislation
- Creates a new legal framework for the animal by-products sector
- Simplifies existing community legislation creating a consolidated legislation dealing with all animal by-products not intended for human consumption.

Article 12 of the Regulation states that all biogas and composting plants that transform animal by-products shall be subject to approval by a competent authority, i.e. the Department of Agriculture, Fisheries and Food.

11.6. Small-Scale Renewable Projects

11.6.1. Planning Exemptions

Planning exemptions were introduced in early 2007 and apply to wind turbines, solar panels, heat pumps and biomass, subject to certain conditions in each case. These exemptions aim to encourage the use of small-scale renewable technologies. The exemptions in relation to bioenergy technologies are summarised.

Wood pellet boilers and stoves have been classed as exempted developments. Where a flue is required, it should be constructed in line with existing building regulations. The addition of an extension or ancillary building to existing premises to accommodate the biomass heating system is now covered by an amendment to existing exempted development classes.

It should also be noted that where an individual wishes to install any class of micro-renewable technology that does not fall within the draft exemptions he/she may apply, as normal, for planning permission from the planning authority. Planning authorities are being provided with clear guidance on the operation of the exemptions. In this guidance Planning authorities are being instructed that any application for permission should be assessed on its own merits.

11.6.2. Smart Meters

The Government's White Paper ([15]) refers to the potential of smart meters to deliver benefits for energy suppliers and consumers. Smart meters will facilitate the incorporation of on-site energy generation at consumers' premises, including bioenergy generation. The Government intends to announce a national five-year programme for the installation of smart meters for all householders in both new and existing houses. The roll-out and funding mechanisms for this programme are expected to be announced by the end of 2007.

Section Four

The Way Forward: The Action Plan

SOUTH-EAST REGIONAL AUTHORITY
ÚDARÁS RÉIGIÚNACH AN OIR-DHEISCIRT

12. BIOENERGY IMPLEMENTATION PLAN FOR THE SOUTH-EAST

The Bioenergy Implementation Plan for the South-East Region is primarily a Plan to promote the sustainable deployment of bioenergy within the South-East Region and to increase the production and consumption of bioenergy within the Region.

The key aims of the Plan are:

- To get all relevant actors in the Region, including local authorities, farmers, suppliers etc., working, in close cooperation to manage, develop and promote renewable energy in the Region
- To provide a structured framework for the target audience to utilise the plan for coherent development and progress in the area of bioenergy
- To gather data in relation to the scope and potential for bioenergy development in the Region based on the availability of resources and technologies
- To identify and reduce the barriers to the development of bioenergy in the Region.

The target audience for the Plan include the following:

- Farmers
- Local Authorities
- Developers
- Producers
- Suppliers
- The public, businesses etc.
- Central Govt./State Agencies: Dept. of Communications, Energy and Natural Resources
  Teagasc
  Environmental Protection Agency
  Sustainable Energy Ireland.

The Implementation Plan identifies and establishes regional targets to increase the use of bioenergy for the Region's energy needs by 2010 and 2020. These targets have been subdivided into the three energy sectors: heat, electricity and transport.

The Plan also suggests a breakdown of the level of installation of bioenergy systems required across the economic sectors to achieve these targets: residential, commercial and industrial for heat and/or electricity and for the transport sector.

12.1. Current Situation within the Region

The Plan has identified and highlighted the baseline situation within the South-East by assessing the current energy consumption and by assessing the bioenergy resources available within the Region. Table 12.1 outlines the current levels of fuel consumption within the Region and biomass represents 1.5% of this balance. The Bioenergy Implementation Plan aims to increase the contribution of bioenergy to the Region's energy needs and has set specific sectoral targets to achieve this.

Table 12.1: Current Regional Energy Balance

Units=TJ	COAL	PEAT	OIL	NAT GAS	RENEWABLES (ex biomass)	Biomass	ELECTRICITY	TOTAL
TFC	1,703	1,282	38,358	6,879	0	872	9,603	**58,697**
%	2.9	2.2	65.3	11.7	0.0	**1.5**	16.4	
CO_2 (Mt)	0.16	0.14	2.81	0.39			1.70	**5.20**

Note: See Chapter 5 for the detailed energy balance for the South-East Region

In order to set regional targets it was necessary to assess the level of bioenergy resources currently available within the Region. Table 12.2 presents the estimated current resources within the Region.

Table 12.2: Summary of Regional Bioenergy Resources

Resource	Potential Energy (TJ)
Forestry Resources Thinnings and logging residues	1,184
Agricultural Resources Solids: i.e. straw Liquids: i.e. slurries	1,104 406
Energy Crops (OSR, SRC willow, miscanthus)	132
Grass as an Energy Crop	321
MSW	738 Note 2
TOTAL	3,885

Note 1: See Chapter 6 for the detailed resource assessment for the South-East Region
Note 2: Energy from MSW will not be considered when setting regional targets for the lifetime of this Plan. However, this will be reviewed in 2010 and in 2020, as appropriate (see Section 6.7)

12.2. Target Setting for Bioenergy Utilisation within the Region

Using the baseline information from Chapter 5 and Chapter 6 and having regard to the viability analyses that were made on the relevant technologies in Chapter 9, ambitious regional targets have been set for 2010 and also for 2020. The South-East Region has a considerable bioenergy resource, which if properly managed and expanded can supply the Region with a significant proportion of its energy requirements and contribute to achieving national targets for renewable energy penetration.

The targets for the future development of bioenergy within the Region are described in Sections 12.3 and 12.4.

In establishing these targets the following information was used:

- Current uses of bioenergy in the Region (the starting point for bioenergy utilisation)
- Resource assessments (the possible end point for bioenergy utilisation)
- Viability analyses, assessing which resources are viable to use in the different sectors under the current market conditions.

These targets were suggested, based on the assumption that the current energy prices and the current incentive scheme remain more or less unchanged until 2010. From 2010 until 2020, it is assumed that the market conditions will be improved.

The market conditions from 2010 until 2020 can be improved in relation to the following three factors (or a combination thereof):

- Technology development
- Increased fossil fuel prices compared to bioenergy fuel prices
- Increased political attention through use of stronger incentives for fuel switching.

12.2.1. Current Use of Bioenergy in the Regional Energy Balance

Chapter 5 estimated the current use of biomass in the regional energy balance in 2006 to be 1.5%. Table 12.3 shows the final energy consumption, divided according to the economic sub-sectors.

Table 12.3: Current Use of Biomass, According to Economic Sub-sectors

Final Energy Consumption	Biomass Consumption (TJ/Year)	Total Consumption (TJ/Year)	Share of Biomass Consumption (%)
Industry	769	11,433	6.7 %
Transport	15	25,866	0.06%
Residential	77	13,478	0.6 %
Commercial/ public services	11	5,729	0.2%
Agriculture	0	2,191	0.0 %
Total, all sectors	872	58,697	1.5 %

Table 12.3 shows that biomass is used in the industrial sector and in the residential sector. Biomass is not used in the remaining economic sectors in the Region. The current use of biomass is mainly wood-fuel.

Table 12.4: Current Use of Biomass, According to End-use Sub-sectors

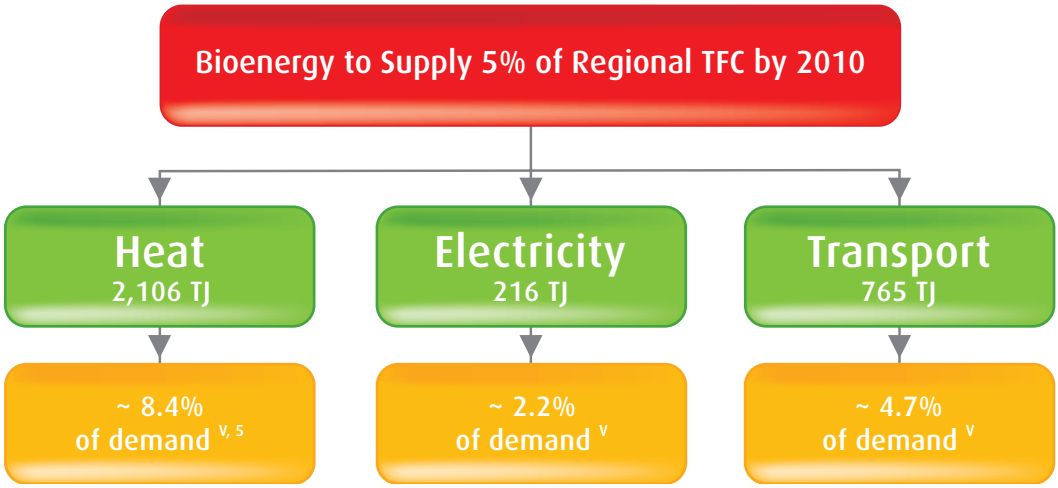
Final Energy Consumption	Biomass Consumption (TJ/Year)	Total Consumption (TJ/Year)	Share of Biomass Consumption (%)
Heating sector	857	23,228	3.7%
Electricity sector	0	9,603	0.0%
Transport sector	15	25,866	0.06%
Total, all sectors	872	58,697	**1.5%**

In Table 12.4, the final energy consumption, as taken from the regional energy balance, is divided into the three sub-sectors considered in this study, namely the heat, electricity and transport sectors. The figure for electricity consumption does not include energy losses at the power plants.

12.3. Regional Targets for 2010

In order to estimate the potential benefits of increased bioenergy deployment, it is necessary to make some assumptions as to what the energy balance is likely to be in 2010. The Government has placed significant emphasis on the role of energy efficiency across all sectors in achieving the fuel diversity and GHG emissions reduction targets. For the purpose of this assessment, the TFC in 2010 is assumed to increase by 5% on the current situation.

The following targets for bioenergy deployment in the South-East Region have been set for 2010. Individual sectoral targets for heat, electricity and transport have been established, with the emphasis on bioenergy consumption for heating purposes. This is due to the fact that the large proportion of the bioenergy resource is from wood fuel and the technologies are proven and widely available within the Region.



[5] It is assumed that energy consumption in 2010 will increase by 5% on 2006 figures

The Bioenergy Implementation Plan for the South-East Region has identified the three areas of Heat, Electricity and Transport Fuels for the deployment of bioenergy. Accordingly, targets have been set for the consumption of energy from biomass in these sectors in order to achieve the overall target of 5% of TFC from bioenergy by 2010. These are outlined in Table 12.5.

Table 12.5: Sectoral Targets for 2010

Sector	Energy from Biomass Target (TJ)	% of Overall Target	Regional Resource
Heating	2,106	68.2	Forestry resource and SRC willow
Electricity	216	7	Forestry resource and agricultural resources
Transport	765	24.8	Energy crops
TOTAL	**3,087**		

12.3.1. Achieving the 2010 Sectoral Targets

Heat Sector

In order to achieve the target to increase the production of heat from bioenergy by 2010, the installation of biomass heating systems in the domestic, commercial and industrial sectors will be required across the Region.

Domestic

The installation of at least 3,000 biomass boilers with a capacity of 20 kW each over the next three years will provide a bioenergy supply of 486 TJ per annum[6].

Commercial/Industrial

The installation of 170 boilers with a capacity of 500kW over the next three years will provide a bioenergy supply of 1,102 TJ per annum[7].

Industrial CHP

The installation of a 10 MW biomass based CHP-Plant in the Region by end of 2010 will generate heat from bioenergy. In general 60% of energy generated by a CHP-Plant is in the form of heat, which is equivalent to 518 TJ per annum[8].

Electricity Sector

The installation of two 10MW biomass based CHP-Plants would provide 216 TJ of electricity from bioenergy[9].

Transport Sector

Green Biofuels Ireland Ltd. is currently constructing a biodiesel plant in New Ross, Co. Wexford and intends to commence production by the end of 2008. This will aim to produce 32 million litres of biofuels, which is equivalent to 1050 TJ of energy from biomass. Assuming that approx 50% of this biodiesel will be consumed within the Region, this equates to 525 TJ of transport energy from biofuels.

In addition, two pure plant oil (PPO) producing companies based in the South-East – Biogreen Energy Products Ltd. and Goldstar Oils Ltd. – have been awarded Mineral Oil Tax Relief (MOTR) and will produce 14 million litres of PPO by the end of 2010. This is equal to 480 TJ of energy from biofuels and if the assumption is made that half of this PPO will be consumed within the Region, this equates to 240 TJ of transport energy from biomass.

12.3.2. The Impact of the 2010 Targets

The potential impact of achieving the regional targets for 2010 has been assessed from the point of view of estimated CO_2 emissions in Tables 12.6 and 12.7.

[6] Full load operation of a domestic boiler is assumed to be 2,500 hours/year with a 90% average efficiency
[7] Full load operation of a commercial boiler is assumed to be 4,000 hours/year with a 90% average efficiency
[8] Full load operation of an industrial CHP-Plant is assumed to be 6,000 hours/year
[9] In a CHP-Plant the distribution of energy between electricity and heat is approximately 25% and 60%, respectively

Table 12.6: Estimated 2010 Regional Energy Balance

Unit = TJ	Coal	Peat	Oil	N Gas	Renewables	Biomass	Electricity	Total
TFC	1,788	1,346	40,276	7,223	0	916	10,083	61,632
%	2.9	2.2	65.3	11.7	0	1.5	16.4	
CO_2 (Mt)	0.17	0.14	2.95	0.41			1.80	5.47

Note: Assume a 5% increase in TFC on 2005 levels and no increase in the contribution made by biomass

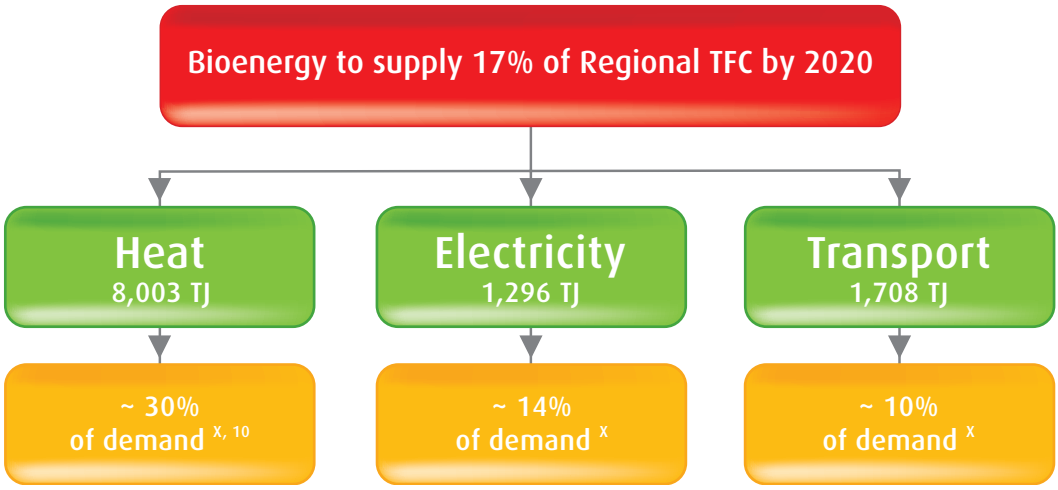
Table 12.7: Estimated 2010 Regional Energy Balance (incorporating targets)

Unit = TJ	Coal	Peat	Oil	N Gas	Renewables	Biomass	Electricity	Total
TFC	1,724	1,298	38,835	6,966	0	3,087	9,722	61,632
%	2.8	2.1	63.0	11.3	0	5.0	15.8	
CO_2 (Mt)	0.16	0.14	2.85	0.39			1.72	5.26

Note: Assume a 5% increase in TFC on 2005 levels and 5% of TFC to be supplied by biomass

Thus, the potential savings of CO_2 emissions from the South-East Region by increasing the contribution by biomass to 5% of the TFC by 2010 is 0.21 million tonnes of CO_2.

12.4. Regional Targets for 2020



[10] It is assumed that energy consumption in 2020 will increase by 10% on 2006 figures

The Bioenergy Implementation Plan for the South-East Region has identified the three areas of Heat, Electricity and Transport Fuels for the deployment of bioenergy. Accordingly, targets have been set for the consumption of energy from biomass in these sectors in order to achieve the overall target of 17% of TFC from bioenergy by 2020.

Table 12.8: Sectoral Targets for 2020

Sector	Energy from Biomass Target (TJ)	% of Overall Target	Regional Resource
Heating	8,003	72.7	Forestry resource and energy crops, e.g. willow (both indigenous and imported)
Electricity	1,296	11.8	Forestry resource, energy crops and agricultural resources
Transport	1,708	15.5	Energy crops (both indigenous and imported)
TOTAL	**11,007**		

12.4.1. Achieving the 2020 Sectoral Targets

Heat Sector

In order to achieve the target to increase the production of heat from bioenergy by 2020, the installation of further biomass heating systems in the domestic, commercial and industrial sectors will be required across the Region.

Domestic

The installation of at least 10,000 biomass boilers with a capacity of 20 kW each over the period from 2010 to 2020 will provide a further bioenergy supply of 1,620 TJ per annum.

Commercial/Industrial

The conversion of a further 130 MW to bioenergy heating systems over the period 2010 to 2020 will provide a further bioenergy supply of 1,685 TJ per annum. This roughly equates to the installation of 260 boilers with a capacity of 500 kW.

Industrial CHP

The installation of a further 50 MW of biomass based CHP in the Region by the end of 2020 will generate energy for heat of the order of 2,592 TJ per annum.

Electricity Sector

The installation of the 50 MW of biomass based CHP would provide 1,080 TJ of energy for electricity.

Transport Sector

The Government has committed to introducing a Biofuels Obligation Scheme which will require fuel distributors to achieve an average of 10% biofuels (on an energy basis) of their total annual fuel business by 2020. This equates to 1,708 TJ of energy for road transport to be supplied by biofuels by 2020.

It is expected that this target will be met by a combination of indigenously produced biofuels and a certain level of imports. Any raw material that is imported into the Region for bioenergy should come from a source that meets with national and EU standards for quality and sustainable production.

12.4.2. The Impact of the 2020 Targets

The potential impact of the achievement of the regional targets for 2020 has been assessed from the point of view of estimated CO_2 emissions in Tables 13.9 and 13.10.

Table 12.9: Estimated 2020 Regional Energy Balance

Unit = TJ	Coal	Peat	Oil	N Gas	Renewables	Biomass	Electricity	Total
TFC	1,873	1,410	42,195	7,567	0	959	10,563	64,567
%	2.9	2.2	65.3	11.7	0	1.5	16.4	100
CO_2 (Mt)	0.18	0.15	3.09	0.43			1.87	5.72

Note: Assume a 10% increase in TFC on 2006 levels and no increase in the contribution made by biomass

Table 12.10: Estimated 2020 Regional Energy Balance (incorporating targets)

Unit = TJ	Coal	Peat	Oil	N Gas	Renewables	Biomass	Electricity	Total
TFC	1,577	1,187	35,529	6,372	0	11,007	8,895	64,567
%	2.4	1.8	55.0	9.9	0	17.0	13.8	
CO_2 (Mt)	0.15	0.13	2.60	0.36			1.57	4.81

Note: Assume a 10% increase in TFC on 2006 levels and 17% of TFC to be supplied by biomass

Thus, the potential savings of CO_2 emissions by increasing the contribution by biomass to 17% of the TFC by 2020 is 0.91 million tonnes of CO_2.

The 2020 targets will be reviewed at the end of 2010 with regard to progress made and will be adjusted accordingly.

12.5. Implementing the Plan

The South-East Regional Authority is assuming responsibility for the co-ordination of the implementation of this Plan. SERA will be assisted in this role by a Steering Committee which will be established within the Region. This Steering Committee will have the responsibility for identifying and securing sources of funding for the successful implementation of the Plan. In particular, the Local Energy Agencies (LEAs) have a key role in implementing the Plan and achieving the regional targets. The LEAs need to be adequately resourced and supported in order for them to successfully fulfil the role assigned to them in the Plan.

To assist with the implementation of the Plan, a number of key actions have been identified. These action items have been developed as a means to address the barriers identified in Chapter 10 and to successfully achieve the regional targets for bioenergy deployment in the three energy sectors: heat, electricity and transport.

The Action Items have been subdivided into the following categories:

1. Establish the Framework for Implementation
2. Create coherent planning objectives across the Region
3. Promote awareness of the potential for Bioenergy among all Stakeholders
4. Successful achievement of Regional Targets for the Heat Sector
5. Successful achievement of Regional Targets for the Electricity Sector

6. Successful achievement of Regional Targets for the Transport Sector
7. Progress Monitoring.

Each action item has been assigned to a particular agency or body within the Region that will have responsibility for overseeing the completion of this item and for reporting the progress back to SERA.

1. Framework for Implementation				
Objective		Key Actions	Responsibility	Timeframe
1	Establish a Steering Committee to assist with and promote the implementation of the Plan	• Liaise with the key stakeholder bodies in the Region seeking their nomination to the Steering Committee	SERA	December 2007
		• Appoint the relevant bodies/nominees to the Steering Committee	SERA	End 2007
2	Publish the South-East Regional Bioenergy Implementation Plan	• Disseminate Regional Implementation Plan amongst the local/public authorities/agencies, planning departments, farmers groups, all public/private sector stakeholders etc. within the Region, and also to appropriate bodies outside the Region • Launch the Implementation Plan at a strategic time to ensure maximum amount of publicity • Investigate potential to release a short brochure summarising the aims and key findings of the Plan • Use established media links within the Region to promote the Plan	SERA (With support from the Steering Committee)	End 2007
3	Identify funding for the Plan	• Investigate sources of funding and identify resources for the Plan's implementation	All Steering Committee members	Ongoing
4	Establish key contacts with all the key members of the Ministerial Task Force on Bioenergy	• Each Steering Committee member will identify a key Government Department to liaise with at a national level in order to be directly aware of any decisions and progress made by the Ministerial Task Force	Key Steering Committee members	End 2007
5	Liaise with other Regional Authorities to share experiences on the implementation of Bioenergy Plans or related strategies/plans	• Establish links with other regions • Exchange information on the approach taken to increase the uptake of Bioenergy within the Region • Disseminate all findings to the Steering Committee	SERA	Ongoing

2. Establish Coherent Regional Planning Objectives				
Objective		Key Actions	Responsibility	Timeframe
1	Include specific coherent Bioenergy development policy objectives in all County & City Development Plans within the Region	• South Tipperary County Development Plan (CDP)	Forward Planner	Prior to completion of current review
		• Carlow CDP	Forward Planner	Prior to completion of next review
		• Kilkenny CDP	Forward Planner	Prior to completion of current review
		• Wexford CDP	Forward Planner	Prior to completion of next review
		• Waterford County DP	Forward Planner	Prior to completion of next review
		• Waterford City DP	Forward Planner	Prior to completion of current review
2	Incorporate bioenergy policies into the Regional Planning Guidelines (RPG)	• Include specific Bioenergy development policy objective supporting the deployment within the Region in the RPG	SERA	Due for review in 2009
3	Development of Specific Planning Policies/ Guidelines	• Determine if specific conditions relating to the use of Bioenergy could be conditioned when granting a planning permission • Preparation of a common planning policy to distinguish between agricultural and commercial activities with regard to Bioenergy developments	SERA	Due for review in 2009
		• Evaluate if the Development Contribution Schemes could be amended to favour developments with integrated Bioenergy elements as opposed to those reliant on other energy sources, e.g. Fossil fuels	Local Authorities	Mid 2008
		• Local Authorities (LAs) to promote the use of Bioenergy via their websites, newsletters etc.	Local Authorities	January 2008
		• Explore the feasibility of developing guidelines to evaluate planning permission applications taking Bioenergy usage into account (i.e. similar system to the site suitability assessments for septic tanks)	Local Authorities	Mid 2008

3. Promote Awareness of the Potential of Bioenergy among Stakeholders in the Region				
Objective		Key Actions	Responsibility	Timeframe
1	Create awareness across all LA Directorates of the obligations outlined in the Bioenergy Action Plan and the White Paper	• Prepare and disseminate an information memorandum on the obligations of LAs • Promote awareness among all LA Directorates of the existence of the Bioenergy Implementation Plan and the targets it contains	Energy Agencies	Ongoing
2	Develop a common level of understanding among planners with regard to the application of Bioenergy technologies	• Preparation of presentations on the use of Bioenergy to be delivered to all planners within the Region	Energy Agencies	Mid 2008
3	Energy Agencies to be informed of all LA led development initiatives	• Mechanism to be developed to inform Energy Agencies of all developments intended to be undertaken by or on behalf of the LAs	Energy Agencies	December 2007
		• Where applicable, feasibility studies should be undertaken to consider the use of Bioenergy technologies in these proposed developments (e.g. social housing developments)	Energy Agencies	Ongoing
4	Continue to raise public awareness in the Region with regard to the available bioenergy options	• Regionalise appropriate elements of national energy awareness campaigns to meet the specific needs of the South-East Region	SERA & Energy Agencies	Ongoing
		• Continue the dissemination of promotional material, e.g. fact sheets, government incentive schemes etc.	SERA & Energy Agencies	Ongoing
		• Use the newsletters and websites of the Steering Committee members to promote Bioenergy in the Region	All Steering Committee Members	Ongoing
		• Provide regular briefings to regional and local media contacts	All Steering Committee Members	Ongoing
		• Investigate the possibility of an annual regional conference/exhibition to foster links between producers, developers and consumers	SERA & Energy Agencies	Mid 2008

For these sectoral targets to be achieved, all links in the supply chain must be robust and sustainable to ensure sectoral growth in the Region. The key supply chain links are: grower – processor – distributors – technology providers – end consumers.

4. Heat Sector: To increase Heat Production from Wood Biomass in the Region				
	Objective	Key Actions	Responsibility	Timeframe
1	The successful achievement of the Regional Targets: Bioenergy to supply 8.4% of the Regional Heat Demand by 2010 Bioenergy to supply 30% of the Regional Heat Demand by 2020	• Publicise the Regional Targets to the relevant stakeholders (local authorities, industrial/ commercial users, the agricultural sector, the public)	SERA (with support from the Steering Committee)	December 2007
		• Co-ordinate with SEI to promote the uptake of the Greener Homes Scheme, ReHeat Scheme, Biomass CHP Scheme etc. in the South-East Region	SERA & Energy Agencies	Ongoing
		• Investigate the possibility of developing planning guidance with regard to the development of the wood fuel industry (wood chipping and drying) in the Region	Regional Planners	Mid 2008
		• Publicise demonstration projects and lessons learned	SEI & Energy Agencies	Ongoing
		• Evaluate the use of the planning system to stimulate market growth	Planners	Mid 2008
		• Liaise with the OPW to identify at least one State Building within the Region that could be eligible for conversion to a bioenergy heating system	Energy Agencies	End 2007
		• Make contact with the Health Service Executive to assess the potential of converting a hospital within the South-East Region to a renewable heating system	Energy Agencies	End 2007
		• Identify schools in the Region that have the potential to convert to biomass heating. Liaise with the Department of Education and Science	Energy Agencies	End 2007
		• Promote the use of bioenergy heating systems in local authority buildings and offices	Energy Agencies	Ongoing
		• Investigate the opportunities for district heating in the Region	SERA	Mid 2008
2	Establish the use of willow & miscanthus for future bioheat production.	• Promote the uptake of the BioEnergy Scheme to increase the growth of short rotation coppice willow for bioenergy purposes in the South-East • Encourage the growth of miscanthus for bioenergy in the Region and disseminate information on the combustion of miscanthus for bioheat	Teagasc	Ongoing

5. Electricity Sector: To increase Electricity Production from Biomass in the Region			
Objective	**Key Actions**	**Responsibility**	**Timeframe**
The successful achievement of the Regional Targets: Bioenergy to supply 2.2% of the Regional Electricity Demand by 2010 Bioenergy to supply 14% of the Regional Electricity Demand by 2020	• Publicise the Regional Targets to the relevant stakeholders (local authorities, industrial/ commercial users, the public)	SERA (with support from the Steering Committee)	December 2007
	• Co-ordinate with SEI to launch and promote the Biomass CHP Scheme in the South-East Region	SERA	Ongoing
	• Liaise with the DCENR to promote the REFIT scheme for the sale of electricity to the national grid	All Steering Committee Members	Ongoing
	• Promote the use of biomass CHP amongst the commercial and industrial sectors in the Region	SERA	Ongoing
	• Encourage local authorities to consider installing biomass CHP systems in any new buildings/facilities	SERA	Ongoing
	• Publicise demonstration projects and lessons learned	Energy Agencies	Ongoing
	• Promote the use of farm-scale AD-based CHP-Plants amongst the agricultural sector	Teagasc	Ongoing
	• Investigate the potential for the South-East Region to contribute raw materials (e.g. willow/ miscanthus) to achieve the national target of 30% co-firing by 2015 in the three peat-fired power plants in the country	Energy Agencies	Mid 2008

6. Transport Sector: To increase the Use of the Regional Resources for Biofuels Production in the Region			
Objective	**Key Actions**	**Responsibility**	**Timeframe**
The successful achievement of the Regional Targets: Biofuels to supply 4.7% of the Regional Road Transport Energy Demand by 2010 Biofuels to supply 10% of the Regional Road Transport Energy Demand by 2020	• Promote the use of the energy crop payment amongst the agricultural sector in the Region	Teagasc	Ongoing
	• Encourage the dissemination of information on the planting, growing, yields and harvesting of oilseed rape	Teagasc	Ongoing
	• Monitor the development of biodiesel production from oilseed rape within the Region	Energy Agencies	Ongoing
	• Actively encourage the promoters of biodiesel production facilities to participate in regional activities (e.g. annual conference/exhibition)	SERA & Energy Agencies	Ongoing
	• Develop and launch an awareness campaign in relation to the use of biofuels in private vehicles	SERA & Energy Agencies	Mid 2008
	• Encourage the visible advertising of biofuels at the forecourts	SERA & Energy Agencies	Ongoing
	• Liaise with the Local Authorities in the Region with respect to setting targets for fleet conversion to biofuels and consider publicising these conversions as demonstration projects	Energy Agencies	Dec 2007
	• Monitor progress in the development of a bioethanol production facility and investigate the opportunities for the Region to contribute raw materials to this facility	SERA, Teagasc & Energy Agencies	Mid 2008

7. Progress Monitoring & Evaluation			
Objective	**Key Actions**	**Responsibility**	**Timeframe**
To quantify and monitor progress in the Region with regard to the implementation of the Plan	• Liaise with SEI and the CSO with regard to the collation of relevant data on a regional basis	Energy Agencies	December 2007
	• Update the Regional Energy Balance on an annual basis, including use of bioenergy. Information about use of bioenergy should be divided in the different bioenergy carriers (wood chips, wood pellets, willow, straw, biodiesel, bioethanol and biogas) • Update and further develop the bioenergy resource assessment	SERA	April 2008
	• Develop a mechanism to track progress made in relation to the implementation of the objectives and key actions of this Plan • Provide feedback to the national level regarding the need for actions to be taken at a national level, including need for strengthening of financial incentives, mandatory measures, information and awareness campaigns etc.	All Steering Committee Members	Mid 2008
	• Establish a permanent Steering Committee regarding bioenergy development in the South-East Region and hold Quarterly Progress Review meetings of the Steering Committee	All Steering Committee Members	Ongoing
	• Produce an Annual Implementation Report	SERA	September 2008 (& annually thereafter)
	• Publicise the progress made in achieving targets	All Steering Committee Members	Ongoing
	• Review the Implementation Plan in 2013 and revise targets, if necessary	SERA & Energy Agencies	End 2013

Appendices

SOUTH-EAST REGIONAL AUTHORITY
ÚDARÁS RÉIGIÚNACH AN OIR-DHEISCIRT

Appendix 1

SEI Approved Installers in the South-East Region

Installer ID	Name	Company	Address	Email	Tel
I329	Gordon Broderick	BrodMac	Russelstown, Carlow		086-1293076
I1531	Ciaran Robinson		Tullow, Co. Carlow		086-2704794
I043	Colm Lawlor	ECO Heat Ltd	O'Brien Road, Carlow	info@ecoheat.ie	059-9139626
I512	John O'Hara	Electrical, Plumbing & Heating Services	2 Old Burrin, Carlow	joh2000@eircom.net	086-3979061
I477	David Fleming	Future Energy Heating Ltd.	Tullow, Co Carlow	futureenergyo7@eircom.net	087-9358060
I492	Gerard Kelly	Gerard Kelly Plumbing & Heating	Killeshin, Carlow		086-8141790
I071	Michael Hayden	Hayden and Murphy	Borris, Co. Carlow		059-9773294
I054	Paul Flynn	Heating & Plumbing Ltd.	Tullow, Co. Carlow		059-9151387
I1062	Mervyn Bradley	Heiton Buckley Ltd.	Hacketstown Road, Carlow	pbradley@heitons.ie	059-9133641
I234	John Kavanagh	John Kavanagh H&P	Bagenalstown, Co. Carlow	jkco@eircom.net	087-2753675
I786	John Lennon	John Lennon & Son Heating & Plumbing	Bagenalstown, Co. Carlow		087-2251689
I1203	Michael Nash	Michael Nash Heating & Plumbing	Graiguecullen, Carlow	delaneynash@eircom.net	059-9137409
I792	Mick Martin		St. Mullins, Co. Carlow	mickmartin22000@yahoo.co.uk	059-9724828
I1087	Paul Byrne	Paul Byrne Heating & Plumbing	Kellistown West, Carlow	p.byrne71@eircom.net	059-9148873
I1733	Stephen Nolan	Stephen Nolan Heating & Plumbing	Borris, Co. Carlow	sdmnolan@yahoo.co.uk	086-3168601
I1183	Stewart Greig		Rathoe, Carlow		087-2241384
I1529	Vincent Bailey		Ballickmoyler, Carlow	vincentbailey@eircom.net	086-4082585
I1443	Wesley Jenkinson	Wesley Jenkinson Heating & Plumbing	Bagnalstown, Co. Carlow		087-6732162
I884	Anthony Meehan	Anthony Meehan Heating & Plumbing	Carrick-on-Suir Kilkenny	amplumbing@g.mail.com	087-2839887
I584	Ben Quinlan	Ben Quinlan Plumbing & Heating	Gowran, Co. Kilkenny		056-7726382
I922	Billy Loughman	Billy & Keith Loughman	Keatingstown, Co. Kilkenny	billyjloughman@eircom.net	086-8210706
I239	Jim Blanchfield	Blanchfield Heating	Stoneyford, Co. Kilkenny	blanchfieldheating@eircom.net	056-7728737
I397	Christopher Hudson	C.M. Plumbing	Stoneyford, Co. Kilkenny		087-2395366
I1628	David Healy	David Healy Plumbing & Heating Ltd.	Kells, Co. Kilkenny	davidhealy@gmail.com	086-8051606
I1759	Declan O'Keeffe	Declan O Keeffe Plumbing & Heating	Glenmore, Co. Kilkenny		086-3251023
I1565	Dieter Gerhardt		Callan, Co. Kilkenny	dgerhardt@iolfree.ie	056-7706931

SEI Approved Installers in the South-East Region - Cont'd

Installer ID	Name	Company	Address	Email	Tel
I914	Eamonn Brennan		Dungarvan, Co. Kilkenny		056-7726458
I454	Fran Egan	Egan Plumbing & Heating Services	Thomastown, Co. Kilkenny		087-8345459
I1548	Noel O'Loughlin	Environmental Heating Systems Ltd.	Johnstown, Co. Kilkenny		087-7431827
I782	John Fenlon	F/H Plumbing Heating Ltd.	114 Ashfield East, Kilkenny		087-2297431
I1639	Frank Commins	Frank Commins Plumbing & Heating	Piltown, Co. Kilkenny		086-2736615
I563	Frank Kealy	Frank Kealy Electric	Callan, Co. Kilkenny		086-8338999
I174	Colm Byrne	Glas Energy-GL Solutions	Kells, Co. Kilkenny	colm@glas.ie	056-7728255
I033	Gregory Power	Heat-Tech Solutions Ltd.	Kilkenny	sales@heattech.ie	056-7723324
I1105	James Fitzpatrick	James Fitzpatrick Boiler Services	Hugginstown, Co. Kilkenny		051-898981
I104	Jimmy Wemyss		Thomastown, Co. Kilkenny	jimmywemyss@eircom.net	056-7724856
I474	John Joe Costigan	John Joe Costigan Heating & Plumbing	Castlewarren, Co. Kilkenny		087-2787182
I1202	Keith Smith	Keith Smith Carpentry Services	Castlecomer, Co. Kilkenny	keithsmith2005@turcom.net	056-4442768
I307	Declan Murphy	Macmurph Plumbing & Heating	Thomastown, Co. Kilkenny		056-7754010
I1530	Martin Donnelly		Stonyford, Co. Kilkenny	eithnewall@hotmail.com	087-6502651/ 087-9062399
I1580	Dermot Fennelly	M.D. Fennelly Limited	Thomastown, Co. Kilkenny	manddfenelly@eircom.net	056-7724583
I1330	Michael O'Gorman	Michael O'Gorman & Dermot Murphy	Attanagh, Co. Kilkenny		086-8047990
I1331	Martin Maloney	Narabane Plumbing	Kilmacow, Co. Kilkenny	mbnarabaneplumbing @eircom.net	087-6536022
I255	Richard O'Keeffe	O'Keeffes Rathmore	Inistioge, Co. Kilkenny	tossa@eircom.net	056-7758440/ 086-8872461
I1247	Martin Kennedy	One Stop Green		onestopgreen@eircom.net	051-427912
I432	Pearse Toner	Pearse Toner Heating Ltd.	Castlecomer, Co. Kilkenny	pearse@ pearsetonerheating.com	087-3230054
I859	Peter Stapleton		Thomastown, Co. Kilkenny		087-2621416
I238	Ray Kearney	R.J.K. Services	Callan, Co. Kilkenny		086-8194941
I1390	Richie Reade	Reade Plumbing & Heating Ltd.	Mullinavat, Co. Kilkenny		087-6682909
I473	Richard McMahon	Richard McMahon Developments	Knocktopher, Co. Kilkenny		087-2549564
I659	Shay Downey	Shay Downey Plumbing & Heating	Ballyragget, Co. Kilkenny		056-8833148
I1374	Stephen Byrne		Graignamanagh, Co. Kilkenny		087-9399821
I869	Jim Tierney	Swiftheat	Ballyragget, Co. Kilkenny	swiftheat@esatclear.ie	087-2509866

SEI Approved Installers in the South-East Region - Cont'd

Installer ID	Name	Company	Address	Email	Tel
I1682	Michael Langan	Tellus Energy Ltd	Kilmacow, Co. Kilkenny	cnclouis@gmail.com	086-8338292
I1683	Francis Langan	Tellus Energy Ltd	Kilmacow, Co. Kilkenny	fran.tellusenergy@gmail.com	086-2653217
I1730	Thomas Moore		Tullaroan, Co. Kilkenny		056-7769461
I518	Patrick Hennessy	T.J. Energy Solutions	Paulstown, Co. Kilkenny	tjenergysolutions@eircom.net	059-9726831
I921	Tomas Dowling	Tomas Dowling Plumbing & Heating	Ballyragget, Co. Kilkenny		087-9436924
I1090	Anthony Glynn	AG Plumbing & Heating	Roscrea, Co. Tipperary		086-3677711
I1605	Aidan Kennedy	Aidan Kennedy Heating & Plumbing	Nenagh, Co. Tipperary		083-3009772
I1768	Kenneth McCallum	Airoption Ltd.	Clonmel, Co. Tipperary	ken@airoption.com	052-70792
I166	Adrian Whelan	AMW Heating & Plumbing	Carrick-on-Suir, Co. Tipperary	adrianmwhelan@eircom.net	051-645145/ 086-8590490
I1176	Vincent O'Toole	AV Plumbing	Newport, Co. Tipperary	avplumbingltd@eircom.net	061-373794
I1572	Bernard Bourke	Bernard Bourke Plumbing & Heating	Clonmel, Co. Tipperary	bernardbourke@eircom.net	052-27098
I046	Colm O'Sullivan	Colm O'Sullivan Heating & Plumbing	Clonmel, Co. Tipperary	o-sullivanjen@hotmail.com	052-36851
I647	Dan Kavanagh	Dan Kavanagh Mechanical	Scalaheen, Co. Tipperary	dkavanagh1001@hotmail.com	086-1546599
I1231	Don Moloney	Don Moloney Heating & Plumbing	Cashel, Co. Tipperary		052-62110
I1391	Gerard Cantwell	EGPS Ltd.	Thurles, Co. Tipperary	info@egps.ie	0504-44437
I997	Sean Gaynor	Evergreen Energy Ltd.	Nenagh, Co. Tipperary	sean.gaynor@evergreenenergy.ie	086-2345516
I1712	Fergal Gallagher	Fergal Gallagher Plumbing & Heating	Lattin, Co. Tipperary	fergalgallagher@hotmail.com	087-8752882
I815	John Fennessy	Frank Fennessy Ltd.	Clonmel, Co. Tipperary		052-21518
I030	Declan Crosse	Gerkros Heating Technology	Tipperary Town	info@gerkros.ie	062-71105
I288	Gerard McKenna	GFC Technologies Ltd.	Clonmel, Co. Tipperary	gfctech@oceanfree.net	087-2514398
I1452	Shane Barrett	GreenNrg	Nenagh, Co. Tipperary	shanebarrett@thevillage.ie	067-27747
I638	Damien Dolan	Greentec	Clogheen, Co. Tipperary	info@greentec.ie	1890 882 998
I323	Harry Arndt		Bansha, Co. Tipperary	h.m.arndt@gmx.net	087-2923641
I788	James Shelly	J.S. Plumbing & Heating	Cashel, Co. Tipperary	jamesshellyinnit@yahoo.co.uk	086-3391011
I1716	Colm Howard	James Colm Howard	Nenagh, Co. Tipperary		087-2870389
I1328	James O'Connor	James O'Connor Heating & Plumbing	Cashel, Co. Tipperary		087-2387443
I599	Joe Quigley	Joe Quigley, Boiler & Plumbing Services	Clonmel, Co. Tipperary	joequigleyplumbingservice @eircom.net	086-8299509
I070	John Byrne	John Byrne Plumbing & Heating	Cahir, Co. Tipperary	johnballylooby@eircom.net	052-65391 / 086-8476308
I219	John O'Mahony		Clonmel, Co. Tipperary	heatherbeatty@eircom.net	052-38397
I108	John Quinlan		Cashel, Co. Tipperary		086-2608149
I1573	Paul Kavanagh	Kamec Engineering Ltd.	Clonmel, Co. Tipperary	info@kamecengineering.com	052-21629

SEI Approved Installers in the South-East Region - Cont'd

Installer ID	Name	Company	Address	Email	Tel
I465	James Murphy	Koldtech Engineering Services	Thurles, Co. Tipperary		0504-51652
I244	Liam Keating	Liam Keating Plumbing	Cahir, Co. Tipperary	keating4heating@eircom.net	087-2549421
I468	Barry Liffey	Liffey Mills	Roscrea, Co. Tipperary	liffey@eircom.net	0505-21477
I829	Malachy Brett		Fethard, Co. Tipperary	brettplumbing@eircom.net	087-2792303
I783	Michael Sheehan	Michael Sheehan Heating & Plumbing	Cahir, Co. Tipperary	michaelsheehan@ireland.com	086-8288200
I1440	David Mitchell	Multi Services	Roscrea, Co. Tipperary		0505-22125
I1260	Christy Rice	Munster Energys	Borrisokane, Co. Tipperary	christyrice@eircom.net	0505-42828
I1253	William O'Halloran	New Inn Heating & Plumbing	Cahir, Co. Tipperary		052-62314
I1106	Niall Mullane	Niall Mullane Heating & Plumbing	Birdhill, Co. Tipperary	niallmullane71@hotmail.com	087-2901128
I1268	Barry Ryan	OAS	Thurles, Co. Tipperary	barryryanoas@hotmail.com	086-8222024
I1670	Seán O'Brien	OB Solar Ltd.	Nenagh, Co. Tipperary	sean@obsolar.ie	086-8278492
I440	Patrick Kennedy		Thurles, Co. Tipperary	paddyal@hotmail.com	0504-22981
I761	Patrick O'Donnell	Patrick O'Donnell Heating & Plumbing	Clonmel, Co. Tipperary		052-24980
I965	Patrick Whelan	Patrick Whelan Plumbing & Heating	Roscrea, Co. Tipperary		087-7859877
I147	John Phillips	Phillips Heating & Plumbing	Cashel, Co. Tipperary		0504-41179/ 087-2356501
I196	William Prout	Prout Plumbing	Fethard, Co. Tipperary		052-31583
I280	Donal Quigley	Rear Cross Construction	Newport, Co. Tipperary		062-79198
I1533	Richard Lambe		Clonmel, Co. Tipperary	samrichardlambe@yahoo.co.uk	086-8780736
I1614	Robert Hennessy	RJ Plumbing	Aherlow, Co. Tipperary	paulinechapman 111@hotmail.com	086-3061737
I1110	Michael Ryan	Ryan Cool Refrigeration	Nenagh, Co. Tipperary		067-26068
I1182	Séamus Barry	Séamus Barry Plumbing & Heating	Thurles, Co. Tipperary	seabar54@eircom.net	087-2647858
I141	Seán Dunne	Seán Dunne Heating & Plumbing	Carrick on Suir Tipperary	martsinnott@hotmail.com	087-2664263
I341	Seán Purcell	Seán Purcell Plumbing & Heating	Templemore Tipperary	tina/purcell@eircom.net	087-2757826
I810	Sean O'Donnell	Sure Plumbing & Heating	Carrick on Suir Tipperary	sureplumbingheating @hotmail.com	087-6805648
I587	James Treacy	T&E Plumbing	Roscrea Tipperary	teplumbing@eircom.net	0505-43283
I707	Micheal Tierney	Tierney Mechanical Services Ltd	Clonmel Tipperary	mjt@tierneymechanical.ie	052-66276
I1677	Thomas Maher	TM Plumbing&Heating	Thurles Tipperary		087-8378791
I650	Tommy O'Brien	Tommy O'Brien Plumbing & Heating	Clonmel Tipperary		087-2657469
I511	Anthony Kennedy	Tony Kennedy Plumbing & Heating	Nenagh Tipperary		067-41619

SEI Approved Installers in the South-East Region - Cont'd

Installer ID	Name	Company	Address	Email	Tel
I373	Tony Morrissey	Tony Morrissey Heating & Plumbing	Cahir Tipperary		086-8146734
I138	Paddy White	White Plumbing & Heating	Cloughjordan Tipperary		086-8356007
I586	Brendan Ryan	B Ryan Plumbing Services Ltd	Ballymacarbry Waterford		087-2721775
I1335	Peter Barry	Chimneys.ie	65A Morissions Road Waterford	sales@chimneys.ie	087-2792605/ 086-3213159
I881	Colin Daly	Colin Daly Plumbing & Heating	Ardkeen Village Waterford		086-8967992
I171	Colm Cheevers		6 Cross Road Business Park, Waterford	info@colmcheevers.com	087-2576049
I1405	Conor Dempsey	Conor Dempsey Heating & Plumbing	Carrick-on-Suir Waterford		087-2079094
I1676	John Conway	Conway & Stewart	Gracedieu, Waterford		086-0620611
I1191	Seán Costin	Costin & Dunford	Cappoquin, Co. Waterford		087-2110502
I1012	John Cummins	Cummins & Ryan	Six Cross Roads Business Pk, Waterford	cummins+ryan@eircom.net	086-8261545
I688	David Dee	David Dee & Sons	Stradbally, Co. Waterford		051-293209
I153	Richard Power	Dick Power Heating	Grantstown, Co. Waterford	diamond.heat@oceanfree.net	051-382138
I085	Donal Walsh	Donal Walsh Ltd.	Dungarvan, Co. Waterford	dwalsh@cablesurf.com	058-42127
I643	Thomas J. Curran	Dungarvan Electronic Services Ltd.	Dungarvan, Co. Waterford		087-6386820
I1068	Eamon Power	Eamon Power Heating & Plumbing	Dunmore East, Co. Waterford		051-383895
I1339	John Seward		Grange, Waterford		087-9639544
I943	Johnny Hewetson	Johnny Hewetson Ltd.	Carrigeen, Waterford	maryhewetson@eircom.net	051-895913
I1655	Brian Spillane	Kennedy Engineering Ltd.	Kilmeaden, Co. Waterford		051-384440
I1173	Lyndon Wilkinson		Cappoquin, Co. Waterford	lyndon@mjd.ie	058-52840
I1525	Niall Mackey	Mackey Plumbing	Ferrybank, Waterford	fiodh5555@hotmail.com	051-830263
I1004	Leonardo Carparelli	Maple Plumbing & Heating	Old Tramore Road, Waterford	carparelli43@hotmail.com	087-2446397
I1773	Mark Sheerin		Leamybrien, Co. Waterford	marksheerin@vodafone.ie	087-2996062
I1536	James McCarthy	McCarthy's Plumbing & Heating	Tramore, Co. Waterford		087-3161738/ 086-1756358
I1762	Michael Organ	Michael Organ Plumbing & Heating Services	Ballygunner, Waterford		087-6778772
I1596	Mark Kiely	MK Plumbing & Heating	Kilmacthomas, Co. Waterford		087-6775752
I020	Sarah Kent	Natural Power Supply	Ballymountain, Waterford	info@nvs.ie	051-832777
I1599	Patrick Power	Patrick Power Plumbing	Dungarvan, Co. Waterford		087-4377205
I1692	Peter Milner		Passage East, Co. Waterford	pmilner1@aol.com	086-0855951
I871	Robert Phelan		Portlaw, Co.Waterford		087-9048618
I113	John Reynolds	Ross Technical Services	Dungarvan, Co. Waterford	barry@rosstechnical.ie	087-2248498

SEI Approved Installers in the South-East Region - Cont'd

Installer ID	Name	Company	Address	Email	Tel
I1583	John Roche	RS Plumbing & Heating	Ferrybank, Waterford	johnrocheplumbing andheating@eircom.net	087-6888399
I434	Oisín Ryan	Ryan Energy Int. Ltd.	130 The Quay, Waterford	info@ryanwaterford.com	086-2574167
I690	Jim Power	The Stove Depot	Cork Road, Waterford	thestovedepot@eircom.net	051-351200
I1619	Tom Grant	Tom Grant Plumbing & Heating	Slieverue, Co. Kilkenny	tomgrant52@hotmail.com	051-832993
I574	Tommy Widger	Tommy Widger Plumbing & Heating	Grantstown, Waterford		086-3834169
I1104	Roger Mee	Town & County Plumbing & Heating	Tramore, Co. Waterford	rogermee@gmail.com	087-2969084
I558	Michael Prendergast	Uni Heat Solutions Ltd.	Dungarvan, Co. Waterford	prendergast12@eircom.net	087-7998329
I1029	Patrick Tobin	Waterford Energy Systems	Ballindud, Waterford	pattobin@gmail.com	086-8316788
I1661	Michael O'Brien	Waterford Gas & Oil Services	Newrath, Waterford		051-833386/ 087-2736007
I344	Maurice Jackson	Waterford Heating & Plumbing	3 Kerry Park Tce., Waterford	waterfordph@eircom.net	051-874564
I168	Anthony Tinney	A.J.T. Services Heat Ltd.	Enniscorthy, Co. Wexford	www.AJTservicesltd.ie	054-36428
I1420	Killian Duignan	Air Con Engineering Ltd.	Enniscorthy, Co. Wexford	info@airconengineering.com	053-9238888
I072	Andrew Murphy		New Ross, Co. Wexford	andrewmurphy@eircom.net	051-389120
I880	Anthony Doyle	Anthony Doyle Heating & Plumbing	Crosstown, Wexford		053-9122628
I1731	Owen Wheeler	Apollo Plumbing & Bathroom Design	Gorey, Co. Wexford		086-8165306
I1210	Stephen Waters	B & K Plumbing	Taghmon, Co. Wexford	bkplumbing@eircom.net	086-3891242
I149	John Dunne	Ballygarrett Plumbing & Heating	Gorey, Co. Wexford	ballygarrettph@eircom.net	087-9366600
I446	Pat Barron	Barrossa Plumbing & Heating	New Ross, Co. Wexford		051-428884
I1738	Bob Moorman		Ballygarrett, Gorey, Co. Wexford	bmoorman@eircom.net	086-0636505
I393	Brendan Butler	Brendan Butler Plumbing Ltd.	New Ross, Co. Wexford		087-4184745
I1439	Brian Jordan		Gorey, Co. Wexford		087-2552199
I988	Barry O'Brien	BWS Construction Services Ltd.	New Ross, Co. Wexford	info@bws.ie	051-820176
I1717	Kieran Delaney	C & M Delaney Ltd.	The Faythe, Wexford	cmdelaney@eircom.net	053-9122854
I119	Tony Hayden	Codex M Engineering Ltd.	Barntown, Co. Wexford	sales@codexm.eu	053-20859
I1288	Philip Tobin	Curris Construction	Curracloe, Co. Wexford	philiprtobin@eircom.net	087-7707284
I549	Damian Dillon	Damian Dillon Plumbing & Heating	Courtown Harbour, Co. Wexford		086-2332850
I051	Aidan Kelly	Dick Kelly and Sons Ltd.	Distillery Road, Wexford	akelly@dks.ie	053-9143267
I542	Steven Butler	Dick Kelly and Sons Ltd.	Distillery Road, Wexford	sbutler@dks.ie	053-9143267
I1615	Eamon Smyth	Eamon Smyth Plumbing Ltd.	Ferns, Co. Wexford	eamon@estherm.com	087-2506079

SEI Approved Installers in the South-East Region - Cont'd

Installer ID	Name	Company	Address	Email	Tel
I1790	Eamonn Sheridan		Enniscorthy, Co. Wexford		087-6457119
I170	Martin O'Mahony		New Ross, Co. Wexford	info@ecobuild.ie	051-445099
I052	Damien Mullins	ECO-NRG	Foulksmills, Co. Wexford	info@econrgltd.com	051-565835
I1483	Aidan Doyle	Eddie Doyle Plumbing	Enniscorthy, Co. Wexford	bayfieldhouse@eircom.net	087-2670821
I074	Michael Flynn	EMF Heating Services Ltd.	Oulart, Co. Wexford	emfufh@eircom.net	0502-55903/ 053-36000
I364	Eugene Styles	Eugene Styles Plumbing & Heating	New Ross, Co. Wexford	e.styles@eircom.net	087-2955393
I1303	James O Farrell	Farr Engineering Ltd.	Enniscorthy, Co. Wexford	farrengine@eircom.net	053-9238066
I205	Jim Furlong	Furlong's Hardware Ltd.	Bunclody, Co. Wexford	jim@jfurlong.com	053-9377630
I1015	Garreth Whelan	Garreth Whelan Plumbing & Heating	New Ross, Co. Wexford		087-2364434
I851	Gerard Roche		Enniscorthy, Co. Wexford	rocheg@eircom.net	087-2583243
I231	George Murphy	GM Industrial & Domestic	Ferns, Co. Wexford	georgemurphy@campus.ie	087-2807364
I1403	Harry Ryan		Enniscorthy, Co. Wexford		087-2360982
I919	James O'Sullivan	Hydro Plumbing Services Ltd.	Gorey, Co. Wexford	hydroplumbingservicesltd @eircom.net	053-9428924
I038	Gerald O'Donoghue	Igneus	Enniscorthy, Co. Wexford	info@igneus.ie	053-9243300
I749	Aidan Mahon	Irish Renewable Energy Systems	Castlebridge, Co. Wexford	ires@eircom.net	087-7618574
I1746	Brian Millar	Joe Millar & Sons Ltd.	Gorey, Co. Wexford	joemillar@eircom.net	053-9421612
I892	John Kehoe	John Kehoe Plumbing & Heating	New Ross, Co. Wexford	jkehoeplumbing@eircom.net	051-388731
I1207	Peter Sommers	Kedco Energy Carlow-Kilkenny	Enniscorthy, Co. Wexford	pete.sommers@kedco.ie	087-0519211
I1205	Kevin Cowman	Kedco Energy Wexford	Enniscorthy, Co. Wexford	wexfordkedcoenergy@kedco.ie	087-9104365
I077	Niall Murphy	Kevin Murphy & Sons Ltd.	New Ross, Co. Wexford	niall@kmas.ie	051-389192
I1249	Tom Doyle	Kildavin Pluming & Heating Ltd.	Enniscorthy, Co. Wexford	doyleheating@eircom.net	087-9274934
I1200	Klaus Lautwein	Lautwein Limited	New Ross, Co. Wexford	klaus-lautwein@web.de	087-4122034
I098	Michael McNamara	McNamara Plumbing & Heating	New Ross, Co. Wexford	mcnamaraplumbing @eircom.net	051-389918
I601	Michael Ryan	Michael Ryan Plumbing & Heating	Cushinstown, Co. Wexford		051-428937
I1647	Stephen Rigby	New Energy Systems	Kilmuckridge, Co. Wexford	stephenrigbyriggs@yahoo.co.uk	05391-30647/ 086-8417967
I137	Michael Schwartz	Off the Grid Renewable Energy	New Ross, Co. Wexford	info@offthegrid.ie	059-9725500
I041	Ollie McPhillips	Ollie McPhillips Ltd.	New Ross, Co. Wexford	mail@ompl.ie	051-389522
I1188	Patrick Webster	P. Webster & Co Ltd.	Enniscorthy, Co. Wexford		053-9234116
I386	Paddy Murray	Paddy Murray Plumbing & Heating	Barntown, Co. Wexford	mhm@iol.ie	053-34348

SEI Approved Installers in the South-East Region - Cont'd

Installer ID	Name	Company	Address	Email	Tel
I523	Patrick Kearns	Patrick Kearns Plumbing & Heating	New Ross, Co. Wexford	plumbing@eircom.net	051-422517
I1345	Paul Lane		Dungarvan Wexford		087-2599873
I776	Paul Murphy	Paul Murphy Heating & Plumbing	Gorey, Co. Wexford		087-2447266
I835	P.J. Phelan	Phelan Plumbing & Heating	New Ross, Co. Wexford		087-9212687
I1088	P.J. Cullen	P.J. Cullen Plumbing & Heating	Foulksmills, Co. Wexford		086-4074321
I027	Peter Firman	P.J. Firman & Co. Ltd.	Wexford	info@firmanplumbing.ie	053-9143018
I330	Pat Kavanagh	PK Plumbing	Gorey, Co. Wexford		087-6392773
I1282	Patrick McGannon	PM Heating & Plumbing Services Ltd.	Barntown, Co. Wexford	pmheating@hotmail.com	053-9120989
I188	Raymond White	Ray White Heating & Plumbing	Bridgetown, Co. Wexford	raywhiteheatingandplumbing @eircom.net	087-2871584
I1780	Richard O'Brien		Newbawn, Co. Wexford	nicholsontilson3 @cablesurf.com	087-9644320
I1547	Richard Stafford		Newbawn, Co. Wexford		051-428684
I057	Robert Murphy	Robert Murphy Heating and Plumbing	Gorey, Co. Wexford	mheating@eircom.net	053-30901
I466	Seán Curtis		Wellingtonbridge, Co. Wexford		087-6187444
I195	Seán Moore	Sean Moore P&H	Mayglass, Co. Wexford	seanmoor@dol.ie	053-9135397
I252	Barry Doyle	Solire Ltd.	Barntown, Co. Wexford	solire@eircom.net	053-9128476
I1412	Paddy Swords	Swords Plumbing & Heating	Crossabeg, Co. Wexford	swordsplumbing@eircom.net	053-9152085
I237	Syl Doyle	Syl Doyle P&H	Enniscorthy, Co. Wexford	syldoyle@eircom.net	087-2449171
I067	Thomas Gregan		Gorey, Co. Wexford	tgregan06@yahoo.ie	053-9421050
I1450	T.J. Quinn	TJ Quinn Heating & Plumbing	Bunclody, Co. Wexford		087-9668415
I741	Tomas McCormack	Tomas McCormack Plumbing & Heating	Foulksmills, Co. Wexford		086-8311339
I1721	Warren Willoughby		Gorey, Co. Wexford		053-9422128
I332	William Harpur		Enniscorthy, Co. Wexford		087-9704222
I272	William Byrne	WJB Plumbing & Heating	Rathaspeck, Wexford		053-9145737

Appendix 2

Selected Demonstration Projects

Project: Kelly's Resort Hotel, Rosslare, Co. Wexford

Technology: Renewable Heat; Woodchip Boiler

Project Summary: Kelly's Resort Hotel & Spa in Rosslare, Co. Wexford is a 4-star hotel with 117 bedrooms, three restaurants, a fitness centre with two indoor swimming pools and a "Sea Spa" Complex. Prior to February 2006, the hotel's heating system consisted of three 150 kW oil-fuelled boilers and consumed over 140,000 litres of oil per year.

Rising energy costs and a desire to reduce carbon emissions prompted the hotel management to change to renewable heat technology. A 350 kW wood-chip boiler was installed and two of the existing oil-fuelled boilers were retained to meet additional demand.

The wood-chip boiler generates a heat output of 226,800 kWh per month which provides 90% of all heating and hot water demand for the hotel throughout the year.

The hotel has invested €104,800 in the project and it received an SEI grant of €26,220 through the Bioheat Boiler Deployment Programme. In comparison with 2005 figures, the hotel has saved almost €25,000 on heating costs in 2006. This means that Kelly's Hotel can expect a three year payback period on its capital investment.

Project: Seskin Farm, Clonmel, Co. Tipperary

Technology: Renewable Heat; Woodchip Boiler

Project Summary: Seskin Farm is a piggery located near Clonmel. Prior to this project the facility was using 43,642 litres of oil as the piggery requires a significant volume of hot water 24 hours a day, 365 days per year.

A desire to reduce energy costs and also to have an ability to predict future energy costs led the owner to consider switching to a wood-fuelled heating system.

A 75 kW heating system and fuel store was installed in June 2005 and the boiler is fuelled on dry wood chip, which is produced and delivered locally. The facility has achieved an 80% reduction in heating costs and has achieved an annual CO_2 saving of 51 tonnes.

Project: St. Columbus Hospital, Thomastown, Co. Kilkenny

Technology: Renewable Heat; Woodchip Boiler

Project Summary: St. Columbus Hospital is a HSE hospital in the South-East which switched over to a 400kW wood chip boiler to provide hot water and space heating for the entire hospital. The system, due for commissioning in July 2007, will displace over 60,000 litres of oil per annum which will result in annual CO_2 savings of 290 tonnes.

This is a leading project for the HSE in the South-East and payback on the investment is expected within two years.

Project: Green Biofuels Ireland, Biodiesel Plant, New Ross, Co. Wexford

Technology: Renewable Biofuel Generation; Biodiesel

Project Summary: Green Biofuels Ireland has commissioned a 30,000 tonne biodiesel plant in New Ross, Co. Wexford. Construction began on the facility in April 2007 and it is expected to be completed in 2008. Green Biofuels Ireland intends to commence the production of biodiesel from oil seed rape, recovered vegetable oils and animal fat.

The raw materials for the facility will be sourced mainly from the company's shareholders, which include existing RVO handlers, as well as Wexford Farmers Co-op which has 4,000 farmer shareholders.

Green Biofuels Ireland was successful in obtaining excise relief under the Government's MOTR scheme, as discussed in Chapter 3. The plant will produce 34 million litres of biodiesel per annum.

Appendix 3

Assumptions for the Viability Analyses

The assumptions for the viability assessment were split into non-technology-specific assumptions, fuel conditions and technology-specific assumptions for the three different case studies.

Non-Technology-Specific Assumptions

The non-technology-specific assumptions are shown in Tables 1 and 2. These tables state general assumptions which among others include price levels, VAT rate, and assumptions regarding full load hours, heat and electricity consumption for an average household and an example of an industry.

Table 1: General Assumptions

	Unit	Value
VAT Level	Year	2007
Fuel Price Level	Year	2007
VAT rate (investments, O&M)	%	21
VAT rate (heating fuel, electricity	%	13.5
Mineral oil tax (MOT), diesel oil	€/litre	0.37
Mineral oil tax (MOT), petrol	€/litre	0.44

Table 2: Full Load Hours & Consumption Assumptions

	Full Load Operation [hours/Year]	Consumption [GJ/Year]	Consumption [MWh/Year]	Note
Domestic boiler	2,500	N/A	N/A	1
Industrial boiler Industrial CHP engine	6,000	N/A	N/A	2
Domestic boiler	N/A	72	20	3
Industrial boiler	N/A	108	30,000	4
Industrial CHP engine	N/A	> 33.75	> 9,375	5

Note 1 The heat load duration curve for an Irish single family house is assumed to be similar to that for a Danish single family house.
Note 2 The industrial boiler and CHP engine is assumed to run on full load 24 hours per day, 5 days a week, 50 weeks
Note 3 According to Dong Energy a 120m^3 house built after 1977 has the following average heat consumption: space heating = 13,200 kWh/y; hot water = 1,875 kWh/y
Note 4 The industrial boiler / CHP turbine is assumed only to run on full load operation
Note 5 It is assumed that the industry sells all generated electricity to the grid.

Assumptions Regarding Fuel

The fuel assumptions are shown in Tables 3 and 4.

Table 3: Assumptions Regarding Fuel Used in Case Study 1 and Case Study 2

	Unit	Fuel Cost €/Unit	Calorific Value GJ/Unit	Notes	Fuel Cost €/GJ	Fuel Cost High Price €/GK
Wood pellets, domestic use (bagged)	tonne	285.5	17.28	1	16.52	
Wood pellets, industrial use (bulk delivery)	tonne	164.4	17.28	2	9.51	
Wood chips, industrial use	tonne	86.5	13.32	2	6.49	
Willow, pellets	tonne	322.5		3	22.40	
Willow, chip	tonne	135		3	9.38	
Natural gas, individual boiler	m^3	0.51	0.040	1,4	12.98	16.22
Natural gas, industrial boiler	m^3	0.45	0.040	2,5	11.29	14.11
Gas oil, domestic use	litre	0.50	0.037	1	13.07	16.34
Light oil, industrial use	litre	0.57	0.037	2	14.01	17.51
Sale price electricity, wood	kWh	0.072	N/A		20	25

Note 1 SEI, Domestic fuels: Comparison of Energy Costs, April 2007
Note 2: SEI, Industrial fuels, April 2007 – SEI, Commercial/Industrial Fuels: Comparison of Energy Costs, April 2007
Note 3: Prices supplied by Rural Generation Ltd.
Note 4: High user commitment rate - assuming a yearly consumption within 13,500 – 24,000 kWh
Note 5: 0.0005% of the consumption is below 15,000 kWh the tariff for consumption above 15,000 kWh is used for all the consumption.
Note: 2-monthly charge of 12.12 € = 72.72€/year

Table 4: Assumptions Regarding Transport Fuel

	Feedstock/ Fuel Cost	Fuel Cost High Price[Note 1]	Calorific Value MJ/kg[41]	Density kg/Litre
Oilseed Rape	240 €/tonne			
Diesel oil	1.085 €/litre [Note 1]	1.356 €/litre	42.7	0.85
Petrol	1.173 €/litre [Note 1]	1.466 €/litre	41.3	0.75
RME biodiesel	-	-	37.3	0.88

Note 1 Retail Prices, June 2007

Technology-Specific Assumptions

The technology-specific assumptions comprise assumptions for domestic boilers, industrial boilers and for the CHP turbine. The assumptions for these technologies are outlined in Tables 5, 6 and.7.

Table 5: Domestic Boiler Assumptions

Parameter	Unit	Pellet Boiler	NG Boiler	Light Oil Boiler
Full load operation hours	H	1,000	1,000	1,000
Installed thermal capacity	MW	0.020	0.020	0.020
Heat generation	MWh/year	20,000	20,000	20,000
Heat efficiency	%	90	108	90
Total investment	€	6,300	3,412.5	3,900
Specific investment in heating boiler	1000 €/MW	470	565.92	646.77
Investment subsidy (1)	1000 €	6.300	0	0
Maintenance costs per year	1000 € per MW	21.559	12.935	43.118
Maintenance costs per year	% of inv.	2.424	2.286	6.667

Note 1 Greener Homes Scheme, Application Guide, Ver 1.4.

In an attempt to represent the market segment of biomass boilers in commercial buildings, small industry and institutions, a comparison was furthermore made between a 100 kW wood chip boiler and a conventional natural gas boiler or an oil fired boiler. The assumptions regarding investments (including subsidy) and maintenance costs are shown in Table 6.

Table 6: Industrial Boiler Assumptions

Parameter	Unit	Wood Boiler (1)	NG Boiler (1)	Oil Boiler (2)
Full load operation hours	H	6,000	6,000	6,000
Installed thermal capacity	MW	5	5	5
Heat generation	MWh/year	30,000	30,000	30,000
Heat efficiency	%	108	101	95
Specific investment in boiler	1000 €/MW	565	350	350
Investment subsidy (3)	1000 €	621.5		0
Total investment	1000 €	2203.5	1,750	1,750
Maintenance costs per year	1000 € per MW	66.105	52.5	52.5
Maintenance costs per year	% of initial inv.	3	3	3

Note 1 "Technology data for electricity and heat generating plants", Danish Energy Authority, 2004.
Note 2 It is assumed that investment and maintenance costs for the industrial oil boiler are the same as those for the gas boiler
Note 3 Renewable Heat Deployment Programme Application Guide, Ver 1.1.

For the analysis of wood fuel based boilers, it was assumed that standard solutions are followed regarding the storage of wood fuel. The following standard solutions are assumed:

- **Wood chips: storage on a concrete floor in an open shed**
- **Wood pellets for an industrial boiler: Storage in a silo**
- **Wood pellets for individual boilers: Pellets are delivered in bags and stored in an existing garage.**

Table 7: Industrial CHP Turbine Assumptions

Parameter	Unit	CHP Turbine (1)
Full load operation hours	H	6,000
Installed thermal capacity	MW-th	5
Installed power capacity	MW-e	1,563
Heat efficiency	%	80
Electricity efficiency	%	25
Steam/heat generation	MWh/year	15,040
Electricity generation	MWh/year	1,469
Specific investment in CHP-Plant	1000 Euro/MW	3000
Investment subsidy (2)	%	35
Economic lifetime of investments	Year	20
Fixed maintenance costs per year	Euro/MW/year	60000
Variable maintenance cost	Euro/MWh	7,1

Note 1 "Technology data for electricity and heat generating plants", Danish Energy Authority, 2004. Storage capacity for the wood fuel is assumed to be available.
Note 2 CHP Deployment Programme, Application Guide, ver. 1.0

Appendix 4

City & County Development Plans in the South-East Region

Public Authority	Policy Regarding Renewable Energy	Provisions in Current Development Plan Relating to Bioenergy
SERA: Regional Planning Guidelines	The South-East Region strongly supports national and international initiatives for limiting emissions of greenhouse gases and encouraging the development of renewable energy sources. The South-East Region actively seeks to implement a share of national targets for renewable energy.	The use of new forests in the Region to provide fuel for wood biomass energy production needs further examination as it is suggested that increased participation in this form of energy production could contribute both to a reduction in CO_2 emissions and benefit the forest industry in the South-East by securing an outlet for wood produced in the Region.
South Tipperary County Council		**Policy ENV 17: Policy on Energy Usage & Renewable Energy** It is the policy of the Council to encourage efforts to reduce energy usage across all sectors. The Council shall also endeavour to promote the use of renewable energy sources and support the development of renewable energy technology.
Carlow County Council	The Council will seek to provide positively for the development of appropriate renewable energy sources, which makes use of the natural resources of the county in an environmentally acceptable manner. The planning authority shall encourage the development of innovative and sustainable energy production, use and conservation practices such as bio-mass development, energy re-use and recovery from industrial and institutional sources and geothermal energy exploitation.	

Kilkenny County Council	The Council strongly supports national and international incentives for limiting emissions of greenhouse gases and encouraging the development of renewable energy resources. The planning and land use policies in the development plan are intended to promote efficiency in the use of energy, transport and natural resources. The National Development Plan 2000 – 2006 acknowledges the potential that the development of alternative and renewable energies has to contribute to sustainable development.	The Council will seek to respond positively to applications for biomass or waste to energy projects in the context of a sustainable energy policy. To encourage the sustainable development of resources in rural areas to foster economic development in such sectors as agriculture, tourism including agri-tourism, forestry, farm diversification, and renewable energy resources.
Waterford County Council		**Policy Inf. 12** To promote and facilitate the use of renewable energy sources (e.g. solar heating; wind energy; wood fuels; biofuels; anaerobic digestion and landfill gas) and energy efficient technologies throughout the County.
Waterford City Council	The City Council will support national and local initiatives in the development of renewable energy resources. The City Council will support the development of a sustainable energy policy both locally and regionally.	
Wexford County Council	Wexford County Council recognises the need to reduce dependence on fossil fuels for energy generation, and is committed to supporting the development of renewable energy resources and increasing the use of renewable energy in all new building projects within the County.	**Policy Inf. 33** To encourage the use of biomass and pellet boilers in all new developments **Policy Inf. 34** To facilitate the development of Biofuel facilities in appropriate locations subject to satisfying all appropriate planning, amenity, engineering and safety criteria.

Appendix 5

Project Steering Committee

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Environmental Protection Agency
Eurostat
Electricity Supply Board
South-East Regional Authority
Sustainable Energy Ireland
Teagasc
Tipperary Energy Agency
Vehicle Registration Unit
Waterford Energy Bureau
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