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Scotland is committed to reduce greenhouse gas emissions by 42% and generate 100% electricity demand equivalent from renewables by 2020. To help meet these targets, the Fife Economy Partnership has outlined an ambition for Fife to become a centre of excellence for renewable energy.

The Renewable Energy Routemap outlines how Fife intends to meet its contribution to the Scottish Government renewable energy generation targets for 2020. It forms an update to the Fife Renewable Energy Opportunities report, published in May 2010, which identified planned renewable energy investments in Fife and estimated their contribution to Scottish Government renewable energy targets.

This Routemap outlines the progress made in Fife’s renewable energy sector since 2009; identifies new economic opportunities; and sets out the interventions required to achieve Fife’s contribution to the national 2020 targets. It should be noted that although Longannet Power Station is located in Fife it is excluded from Fife’s emissions figures due to its national significance as a power generator and carbon emitter.

There has been changes in domestic, national and international renewable energy policy and funding in recent years. To assess the progress Fife is making toward current targets, this Routemap outlines the current renewable energy policies, legislation and targets from the European Commission and both the UK and Scottish Governments.

**EU Policy**

On 15 December 2011, the European Commission adopted the Energy Roadmap 2050. The European Union has also committed to reducing greenhouse gas emissions to 80–95% below 1990 levels by 2050. In the Energy Roadmap 2050 the Commission explores the challenges posed by delivering the EU’s decarbonisation objective while at the same time ensuring security of energy supply and competitiveness. The Energy Roadmap 2050 is the basis for developing a long-term European framework together with all stakeholders.

**Scottish Government Policy**

The Climate Change (Scotland) Act 2009, which came into force in June 2009, sets a target of reducing emissions, including those from international aviation and shipping, by 80 per cent by 2050. It also sets a world-leading interim target for a 42% cut in emissions by 2020.

The latest and most comprehensive Scottish policy document covering renewable energy targets is the 2020 Routemap for Renewable Energy in Scotland.

Produced by the Scottish Government in June 2011, the Routemap is an update and extension to the Scottish Renewables Action Plan 2009 and is expanded to reflect four key targets:

1. 42% reduction in greenhouse gas emissions by 2020
2. 100% electricity demand equivalent from renewables by 2020
3. 11% heat demand from renewables by 2020
4. 30% of overall energy demand from renewables by 2020
Funding and Grants

To ensure the EU, UK and Scotland can achieve the variety of emissions reductions and electricity generation targets a variety of funding and grant provision has been introduced to encourage households, communities and businesses to install renewable energy technology or implement energy efficiency measures. The major grants include:

- European Energy Efficiency Fund (European Investment Bank)
- European Regional Development Fund (European Commission)
- Feed In Tariff (FIT) (UK Government)
- Renewable Heat Incentive Scheme (UK Government)
- Renewable Heat Premium Payment Scheme (Scottish Government)
- Home Renewables Loan Scheme (Scottish Government)
- Low Carbon Skills Fund (Scottish Government)
- National Renewables Infrastructure Fund (Scottish Government)
- Offshore Wind Scotland – POWERS Fund (Scottish Enterprise)

Fife Council and Community Planning Partnership Policy

Fife Council’s Big 8 targets have set the direction for the Council to become ‘the leading green council in Scotland’. Fife Council’s Carbon Emissions Reduction Plan is being reviewed in light of the Public Duty arising from the Climate Change (Scotland) Act 2009. The Council plan sets the practical target of achieving a 3% per annum reduction in carbon emissions until 2050.

Following consultation with residents and communities, the Fife Community Plan 2011-2020 outlines a range of scenarios for Fife in 2020 if we fail to adapt to climate change or to embrace renewable energy technology and energy efficiency. To complement this, a Climate Change Strategy is being developed in partnership with Fife’s major organisations that will inform necessary actions to ensure progress is made towards the national targets.

In October 2011, Fife Council’s management team agreed an energy strategy ‘Building our Energy Future’, covering Fife Council’s estate. The strategy aims to reduce our carbon dependency and significantly increase viable investment in energy efficiency measures for Council buildings, and maximise the opportunity to gain income from its own renewable energy projects.
Fife has made substantial progress in growing a local renewable energy sector and is on course to meet the Scottish Government’s challenging renewable energy targets. This chapter outlines four of the most pressing national climate change targets for Fife drawn from the 2020 Routemap for Renewable Energy in Scotland.

TARGET 1: 42% REDUCTION IN GREENHOUSE GAS EMISSIONS BY 2020

Assessing Fife’s performance in reducing emissions has only been made possible in recent years due to local authority emissions datasets being published by the Department for Energy and Climate Change (DECC).

Using the same methodology as adopted nationally for a 42% reduction against 1990 levels is unfeasible as the data does not go back that far. However, using the most recently available data at local authority level, Fife has still performed favourably. Fife, as a region, has reduced its emissions by 14% from 2005 levels, which outperforms the fall of 12% across Scotland over the same period, according to UK Government figures. In addition, Scottish Government data shows that greenhouse gas emissions have fallen by 28.9% in 2009 against 1990 levels.

The possibility of cutting Fife’s carbon emissions by 42% by 2020 is clearly feasible given that by 2014, Fife’s carbon emissions are anticipated to reduce by 25% of 2005 levels as projects such as Tullis Russell’s biomass Combined Heat and Power (CHP) plant and Diageo’s anaerobic digestion facility, come online and are reflected in national statistics. The commitment of substantial Fife Council resources from transportation, economic development, planning and environmental services was important to enable these projects to be brought to fruition.

To provide a more current estimate of Fife’s performance, Figure 1 illustrates that Fife’s emissions in 2005 amounted to just over 4m tonnes of CO2 (excluding that emitted by Longannet Power Station). Progress from the 2005 baseline has been encouraging, with renewable energy developments in Fife anticipated to reduce carbon emissions by over 1 million tonnes per annum. With continued promotion of renewable energy, the 2020 carbon emissions interim target is clearly achievable in Fife.

Figure 1: Fife - Progress Towards a 42% Reduction in Carbon Emissions

Source: DECC & Fife Council Enterprise, Planning & Protective Services
The Scottish Government signalled a step change in the contribution that renewable technologies should make towards both our climate change ambitions and the provision of a secure and sustainable energy generation source by increasing the target level for electricity generation from renewable sources from 50% to 100% of gross electricity consumption equivalent by 2020. This makes Scotland’s 100% renewable energy target the most ambitious in the European Union.

The increased importance of electricity generation from renewable sources reflects, in part, the success of the Scottish Government energy consenting regime, which remains committed to streamlining the consents process to meet a target of 9 months for determining Section 36 (Electricity Act) applications that do not go to public local inquiry.

Across Scotland in the past four years Scottish Ministers determined a total of 50 energy applications, including consent for 42 renewable projects worth over 2 GW of capacity which puts Scotland in a strong position in terms of implementation.

As Fife Council has robust policies in place, it is likely that not all applications will be granted consent. However, to give a context to the progress being made in renewable energy generation in Fife, analysis of planning applications has been undertaken.

Between 1999 and 2012 (as at 30th January 2012), a total of 737 renewable energy related applications have been made to Fife Council. Analysis of each application has enabled a generation value (megawatt [MW] or kilowatt [kW]) to be matched to the proposed development. This has been aggregated and converted into Gigawatt Hours (GWh). Table 1 outlines the overall generation value of these applications.

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<td>Fife’s Total Electricity Consumption (2005)</td>
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<td>Fife’s Annual Household Electricity Consumption (2005)</td>
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<tr>
<td>Fife’s Renewable Energy Developments*</td>
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Source: DECC and Fife Council Enterprise, Planning & Protective Services
*Note: Includes only developments that are already generating, those that are under construction and those that have received planning permission as at 30th January 2012.
From this analysis, it is clear that existing and potential renewable energy projects, if fully implemented, have the ability to supply enough electricity to power nearly all the domestic properties in Fife.

In addition, Fife Council’s robust planning guidance ensures that proposed renewable energy developments are assessed against land use, environmental and visual criteria outlined in the Fife Wind Energy Supplementary Guidance. Between 1999 and 2012, 124 GWh of renewable energy projects have been refused planning permission, which is enough electricity to power 18% of Fife’s homes for a year.

An inquiry into the achievability of the Scottish Government’s renewable energy targets is being undertaken by the Scottish Parliament’s Economy, Energy and Tourism Committee during 2012. The Committee inquiry will call together the technological, financial and infrastructural challenges of meeting the targets contained in the 2020 Routemap for Renewable Energy. During the inquiry, the Committee will explore the merits of the targets as well as the risks and barriers to these targets being realised. This Renewable Energy Routemap provides this assessment of achievability of Fife’s targets, whilst identifying local constraints and opportunities.

Figure 2 highlights that Fife has made encouraging progress toward achieving its contribution to the national renewable electricity generation target. Potential offshore wind and other renewable energy developments place Fife on course to achieve 100% of its electricity demand equivalent from renewable sources target.
creation and/or extension of district heating networks, the use of waste heat and low carbon heat/Combined Heat and Power.

There are a range of projects that generate heat from renewable sources in Fife. These include, Fife Council’s landfill gas scheme provides heat for 230 homes and 7 public buildings and Tullis Russell’s CHP biomass plant, which is under construction, will also contribute significantly. Fife Council is in the process of constructing an anaerobic digestion plant that will produce renewable power and heat from the treatment of organic waste. In addition, the new Kirkcaldy Victoria Hospital is a £170 million facility that brings together three hospitals under one roof. Two 1 MW woodchip biomass boiler units were installed to meet the buildings heat energy demands. Installing biomass will reduce energy costs and is predicted to save 700 tonnes of carbon dioxide emissions per annum. This range of projects offers the potential for Fife to achieve its 11% target once all are fully operational.

TARGET 4: 30% OF OVERALL ENERGY DEMAND FROM RENEWABLES BY 2020

In recent years, Fife has been outperforming the Scottish average in terms of reducing overall energy demand. Data from the Department for Energy and Climate Change (DECC) outlines that Fife’s total energy consumption reduced by 15% between 2005 and 2009, compared to an 11% reduction across Scotland.

Benchmarking the latest available data for energy generation from renewable energy and waste sources in 2009 against 2005 total energy consumption shows renewable energy sources comprise 1.5% of total energy demand in Fife. This is lower than the Scottish average of 2.6%. However, the bulk of major renewable energy projects in Fife will not be represented in such figures. Should all currently consented renewable energy projects be developed, renewable energy sources could satisfy around 6.5% of Fife’s total energy demand.

As Figure 3 illustrates, achieving 30% of all energy demand in Fife from renewable energy is perhaps the most challenging of the Scottish Government targets.

Progress toward this target is largely dependent on greater research and development, technological breakthroughs and alternatives to fossil fuel based energy generation and transport being adopted by society. Such developments would reduce dependency on oil products and reduce the demand for natural gas and, in conjunction with energy efficiency improvements, would help reduce overall energy demand.

Figure 3: Consumption by Energy Type in Fife, 2009

Source: Department for Energy & Climate Change (DECC)
MEETING FIFE’S RENEWABLE ENERGY GENERATION TARGETS: 5 INTERVENTION ROUTEMAPS

There are a wide range of renewable energy projects operating or planned in Fife. Currently, biomass is the largest contributor to renewable energy generation in Fife.

Ensuring Fife makes its equivalent contribution to the Scottish Government’s renewable energy targets are dependent on a wide variety of factors, including:

- demonstration, installation and maintenance costs of renewable energy technology;
- access to finance;
- planning and consents;
- grid connections;
- availability of skills;
- supply chain and wider infrastructure (such as transport and broadband connectivity);
- innovation and R&D;
- public engagement;
- adoption of low carbon technologies;
- underlying changes to supply and demand; and
- emerging local energy grids and local generation.

Each renewable energy sub-sector will face each of these obstacles to a different extent. Indeed, some technologies, such as wave and tidal power or hydrogen, are at such an early stage of development that they are unlikely to contribute significantly to Fife’s generation targets by 2020. Therefore, the key intervention areas within this Routemap are focussed on:

1. Biomass
2. Public Sector Emissions
3. Microgeneration
4. Onshore Wind
5. Offshore Wind

Activity in the adoption of renewable energy technologies can be accurately reflected through the planning system. Research undertaken on renewable technology applications going through Fife Council’s planning system has yielded interesting results. For example, the increase in domestic and industry applications for renewable energy developments has risen ten-fold in the last two years. Figure 4 shows this increase in renewable energy development applications and highlights the significant pressure placed upon the planning system in Fife. The introduction of schemes such as the Feed In Tariff (FIT) in April 2010, which provides a UK Government subsidy payment for those generating electricity from renewable sources, and the more recent Renewable Heat Incentive Scheme are partly responsible for the surge in applications.

Figure 4: Total Number of Renewable Energy Related Planning Applications Received by Fife Council, 1999-2011

Source: Fife Council Enterprise, Planning & Protective Services
BIOMASS

Ambitions and Targets

Fife is home to a number of pioneering biomass projects, such as Scotland’s first biomass fuelled power plant, owned and operated by Energy Power Resources Ltd at Westfield near Ballingry. The facility uses poultry litter as its primary biomass feedstock; has been operational since October 2000; and employs around 21 people (excluding jobs in the transportation of feedstock). Since then Fife has become home to a number of pioneering biomass developments and, whilst domestic interest in biomass installations to date has been relatively muted, the introduction of the Renewable Heat Incentive (RHI) scheme could potentially trigger greater interest in such installations.

The Renewable Heat Incentive (RHI), which is the first of its kind in the world, will encourage the installation of renewable heat equipment such as solar thermal technologies, biomass boilers and heat pumps and will be introduced in two phases. Phase 1 began in July 2011 and provides financial incentives to non-domestic renewable energy technologies, such as biomass, ground source, water source, solar thermal and biomethane projects that have been installed since July 2009.

The payments will be made quarterly over a 20-year period to the owner of the renewable heat installation. Phase 2 will begin in October 2012, where RHI tariffs for domestic properties will become available at the same time as the introduction of the Green Deal. The UK Government has confirmed that renewable heat installations made in homes since 15 July 2009 will be eligible for the Renewable Heat Incentive provided they meet eligibility criteria. However, the Government has not yet published details on how the RHI will work in the domestic sector.

Current and Potential Deployment

Between 1999 and 2012, 19 planning applications were received for biomass-related projects in Fife. 13 of these applications were related to industrial-scale projects. The total generation capacity for biomass in Fife (discounting 3 weeks for annual maintenance) is summarised in Table 2.

Table 2: Biomass Projects in Fife, 1999-2012

<table>
<thead>
<tr>
<th>Description</th>
<th>Total (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fife’s Total Electricity Consumption (2005)</td>
<td>1,927</td>
</tr>
<tr>
<td>Fife’s Annual Household Electricity Consumption (2005)</td>
<td>743</td>
</tr>
<tr>
<td>Fife’s Total Renewable Energy Developments*</td>
<td>739</td>
</tr>
<tr>
<td>Fife’s Biomass Developments*</td>
<td>533</td>
</tr>
</tbody>
</table>

*Note: Includes only developments that are already generating, those that are under construction and those that have received planning permission as at 30th January 2012.
Once all these biomass projects are operational they will account for 72% of Fife’s total consented renewably-sourced electricity generation.

Any biomass developments that are rated as 50 MW or above are determined by the Scottish Government and are out with the planning powers of Fife Council. One such scheme, Forth Energy’s proposed biomass development in Rosyth, is currently under consideration with the Scottish Government. The electricity generation capacity of this project totals 100 MW (825 GWh). The potential of the Forth Energy scheme is significant as it could double Fife’s total renewable energy generation capacity.

**Progress to Date**

One of Fife’s major employers, Tullis Russell Papermakers, are installing a new biomass Combined Heat & Power (CHP) system in partnership with RWE npower renewables. The facility will cost £200 million and have a rated capacity of 49MWe (404 GWh). Around 50 permanent jobs will be created in the operation of the power plant and a new, off-site biomass fuel processing facility. Around 400 temporary jobs have also been created during the construction phase of the project.

International premium drinks company Diageo have contracted energy specialists Dalkia to install a new power generation plant consisting of a biomass CHP system and an anaerobic digester to help increase their manufacturing output by more than 60%. The project is a 5.5MWe (45 GWh) development that will meet 98% of the site’s thermal energy needs and 80% of its electricity needs, whilst cutting CO2 emissions by 56,000 tonnes per annum. Approximately 20 new jobs will be created on-site. There will also be a number of new outsourced jobs for boiler and chimney maintenance, building maintenance and other services.

**Key Actions**

The role of biomass in achieving Fife’s contribution to the Scottish Government’s 2020 targets is vitally important, not least as the technology has the potential to generate 72% of all Fife’s consented renewable energy. The forthcoming Renewable Heat Incentive is also likely to encourage greater development of biomass schemes.

The role of biomass raises a number of issues, particularly around the supply constraints of biofuels. A report commissioned by Fife Council in 2009 highlighted that an increase in biomass plants will put pressure on the limited supply of fuel currently available locally. If the local market cannot supply the volume of fuel required it is likely the fuel will have to be sourced elsewhere, which could increase the price. This would impact on both the economic and environmental sustainability of existing and future biomass projects. This raises a number of key actions to ensure Fife’s residents and businesses can continue to reap the benefits of biomass as a sustainable energy source:

- Consider and explore the issues, such as the sustainable sourcing of biomass fuels, as part of the planning process.
- Explore district heating options as part of commercial biomass proposals where such development would generate surplus heat.
- Ensure Fife companies can benefit from the likely increase in the demand for renewable heat installations following the introduction of the Renewable Heat Incentive.
- Explore the potential of establishing district heating networks through future development plans.
PUBLIC SECTOR EMISSIONS

Ambitions and Targets

The Climate Change Act places duties on Scottish public bodies to adapt to the effects of climate change, with particular regard to forestry, energy efficiency and waste reduction. Public engagement is a significant feature of the Act, which also includes assessment of carbon footprints.

Fife Council has a proactive approach to reducing carbon emissions from its corporate activities. It has a long history of energy management and is now rolling out a programme to embed carbon management throughout the organisation.

Fife Council management team commissioned the development of an energy strategy for the Council’s assets. Additionally, consideration is to be given to the opportunity arising from the change in legislation enabling the Council to generate revenue from the sale of electricity. The strategy aims to significantly increase investment in energy efficiency measures for our buildings and maximise the opportunity to gain income from renewable energy generation.

Two-thirds of the Council’s carbon footprint is generated from its buildings, of which over half is derived from schools and leisure facilities. In total, Fife Council has over 1,500 buildings in its operational estate, which poses significant challenges, both financially and in energy consumption.

Fife Council is legally required to participate in the UK Government’s Carbon Reduction Commitment (CRC) Energy Efficiency Scheme. Under the CRC Fife Council must measure, report and purchase allowances for the carbon emissions from its use of electricity and gas. The cost per allowance starts at £12 per tonne and is expected to rise annually in line with the Government’s proposed ‘Floor price of Carbon’. Analogies have been drawn to the Council’s experience with the Landfill Tax, which started at £7 per tonne in 1996 and rose to £56 per tonne in 2011. The CRC costs for the Council are expected to be around £0.95m in 2012-13 and over £1m in 2014/15. The only way to reduce this annual cost is to reduce carbon emissions. Fife Council now regards carbon emissions as a second currency with Services provided with carbon budgets.

To minimise the impact of CRC, Fife Council has pledged to reduce its own carbon emissions by 80% by 2050 via its Carbon Emissions Reduction Plan (CERP). That means 80% less carbon emissions from energy use, waste disposal and transport.

The headline targets outlined in CERP are:

- 3% annual reduction in emissions to 2050
- Estimated value at stake of £75.3m by 2021

After staffing costs, energy and fuel costs are the other major annual expenditure. The costs of these are continuing to rise significantly above inflation. It is well known that the energy market is subject to price fluctuations and increases which will impact significantly on Fife and other councils.
Current and Potential Deployment

Fife Council and other public agencies have largely tended to focus on implementing energy efficiency measures and waste management initiatives to reduce carbon emissions. The opportunities for the deployment of renewable energy generation across the public sector fall into two broad categories; site-specific large scale projects, and microgeneration technologies. The former are often connected to other strategies, particularly those for waste and economic development, as part of the delivery mechanisms. More pre-development work is required for these large scale projects to establish feasibility, obtain permissions, generate design, and place contracts. However, microgeneration does not need this level of pre-development work, is replicable in volume and, whilst it may be linked, is not dependent on other strategies.

Between 1999 and 2012, 13 planning applications were submitted for Fife Council renewable energy generation schemes. The generation potential of these projects is summarised in Table 3.

Fife Council’s renewable energy generation forms 3.7% of Fife’s total and is largely derived from the landfill gas schemes. There is a range of potential options for the Council to increase its renewable energy generation capabilities. The following list outlines some of these options.

- **Combined Heat and Power (CHP)** developments for single large sites or clusters of council buildings could comprise a cost-effective load. An initial study in Kirkcaldy identified the town centre area as worthy of further investigation. The Council’s Energy Management Team has some experience of CHP and district heating development at the Lochhead Landfill site, whilst a small CHP plant has been installed in the new Carnegie Primary School, Dunfermline by Education Services. The Council is also developing a proposal with Ore Valley Housing Association to build a CHP and district heating network in Cardenden. Such projects that are connected to the National Grid bring in an income, although no direct carbon emission reductions accrue to the Council.

- **District heating** is not a renewable energy technology in itself but, rather, the means to distribute heat. It does not attract subsidy funding. However, by linking sites together, district heating can make renewable heat generation technology more cost effective. Feasibility studies have been carried out for schemes in Glenrothes and Kirkcaldy. In Glenrothes, a study by Enterprise, Planning & Protective Services outlined that heat from Tullis Russell’s biomass CHP plant could be used in public and commercial buildings in the town centre area. Consideration of district heating also points to partnership working with other organisations to build networks. For instance, the study in Kirkcaldy identified the opportunity to link to NHS sites and other local sources of heat demand.

Table 3: Fife Council’s Renewable Energy Generation, 1999-2012

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</tr>
</tbody>
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Source: DECC and Fife Council Enterprise, Planning & Protective Services

*Note: Includes only developments that are already generating, those that are under construction and those that have received planning permission as at 30th January 2012.*
Large scale wind power (101kW+) development in Fife has largely been by developers with the Council's only experience in its capacity as a planning authority. The deployment criteria are challenging but Environmental Services participated in a Carbon Trust funded study that found there is potential to accommodate both groups and single wind turbines on a number of sites owned by Fife Council. There is also the possibility of entering into partnership with others to develop wind farms. Some of the sites in Council ownership have already been identified as of interest by commercial organisations. Community participation in the development and ownership of wind-power is also a possibility.

Microgeneration potential is likely to be focussed on micro wind and solar/photovoltaic technologies. Within the Council estate there is considerable potential to implement small scale (5-15kW) wind-power schemes and Environmental Services have projected that one third of Council buildings could have a solar array installed. In terms of solar thermal panels, at the prices the Council pays presently, substitution for gas is financially marginal. Substitution is most cost-effective for sites using oil but carbon reduction is greatest when replacing electric hot water. There is potential for cost-effective solar thermal on sites with high daytime hot water demand such as care homes and catering facilities.

Progress to Date

The Council is developing an anaerobic digestion facility at Lochhead Landfill Site that will produce 1.9 MWe and 1.4MWh for export from the treatment of organic waste. The Lochhead Landfill Site landfill gas combined heat and power development was spearheaded by the Council's Energy Management Team in Environmental Services and is operated by a third party. The site currently produces 1.9MW electricity for export to the National Grid and 1MW heat that feeds into the existing district heating scheme in Dunfermline. The Council receives royalties linked to electricity output and heat from the plant supplies over 230 homes and a number of public buildings in the area. A similar plant that produces 1MWe is operational at the council's Lower Melville Wood Landfill Site. There is also potential for additional energy and heat production from the treatment of unsorted waste.

Fife Council Housing Services have invested over £34 million to date in developing lower carbon social housing via energy efficiency improvements to around 10,000 properties, such as installing ‘A’ rated windows and doors, improving insulation and draught proofing, gas central heating and solar panels. Between 2010 and 2015, a further £10m is being invested in similar energy efficiency improvements and an additional £100,000 per annum is being invested in lower energy lighting in communal areas. The improvements have helped to achieve a 38.1% reduction in CO2 emissions – a total reduction of 420,491 tonnes since 1997 and have helped create 1,884 jobs.

Key Actions:

Fife Council is determining how it can best utilise its land and buildings to minimise carbon emissions through Building our Energy Future – the Fife Council Energy Strategy including:

- Completing a Heat Mapping Exercise to determine key projects, opportunities and priorities for renewable heat generation.
- Establishing the feasibility for renewable energy projects within the Council’s estate.
- Undertaking research to assess the wider possibilities for lower carbon transportation in Fife and establish the feasibility of introducing low carbon vehicles to Fife Council’s fleet.
- Maintaining the lower carbon social housing programme
MICROGENERATION

Ambitions and Targets

Microgeneration is the small-scale generation of heat and electric power by individuals, small businesses and communities to meet their own needs, either as an alternative or supplementary to traditional centralised grid-connected power. Microgeneration covers a range of renewable energy technologies including:

- Micro biomass
- Micro hydro
- Heat pumps
- Solar thermal
- Photovoltaic solar
- Anaerobic digestion
- Heat networks
- Onshore wind (developments less than 100kW rating)

Microgeneration activity in Fife began as far back as 1999 when Fife Council granted the first planning consent for a domestic wind turbine. Figure 5 outlines the annual application numbers for microgeneration schemes since 1999, with the surge during 2010 and 2011 partly due to the introduction of the UK Government Feed In Tariff (FIT).

Current and Potential Deployment

In order to understand the contribution of microgeneration as part of the renewable energy mix, Fife Council commissioned AEA Consultants to undertake an assessment of progress. The study found that over the first year of the Feed In Tariff (FIT) scheme, 426.8 kWe of capacity (87 installations) were registered under the FIT in Fife. The microgeneration schemes in Fife represent 2% of the capacity under the FIT in Scotland, but 6.3% of the number of installations. Since the AEA study only analysed the first year of FIT (April 2010 to March 2011), data has been obtained from OFGEM to illustrate the progress made throughout the remainder of 2011.

From 1st April 2011 to 31st December 2011, OFGEM data showed that there were a further 116 installations in Fife eligible for FIT, which doubled generating capacity by 501 kWe to 1,043 kWe.

In total, photovoltaic installations as a proportion of microgeneration has increased significantly in comparison to small scale wind energy. Figure 6 highlights that 182 photovoltaic and 7 wind installations have been implemented between April and December 2011. Subsequently, photovoltaic energy now forms 70% of Fife’s microgeneration renewable energy capacity.

Figure 5: Annual Microgeneration Planning Applications Received by Fife Council, 1999-2011

![Graph showing annual microgeneration planning applications received by Fife Council, 1999-2011.](Source: Fife Council Enterprise, Planning & Protective Services)
Installations registered under the FIT receive payment for every kilowatt hour (kWh) of electricity generated. The tariff level paid to the installation is dependent on the type of technology and the size of the system. The tariff levels have been set in order to provide a rate of return on investment of between 5% and 8%. However, the UK Government is currently consulting on proposing further reductions to solar PV tariffs with an eligibility date from 1st July 2012 and changes to the FIT rates for other renewable electric technologies from 1st October 2012. As part of the consultation exercise the UK Government are also asking whether the period for which the FIT is paid should be reduced from 25 to 20 years.

**Progress to Date**

A £300,000 investment by Muir Group has seen the largest photovoltaic (PV) installation in Central Scotland being undertaken at their headquarters in Inverkeithing. The PV panels will cover an area of about 690 m² and are expected to generate 80,000 kWh of energy every year, which will save about 42,000 kg of CO₂ annually. The new solar PV system will make significant savings on energy costs with any surplus electricity being sold to Scottish Power on an agreed export tariff.

Green Business Fife (www.greenbusinessfife.co.uk) is a leading environmental business network with over 350 active members and a steering group that represents both the private and public sectors. The aim of Green Business Fife (GBF) is to help companies improve their resource efficiency and minimise the environmental impact of their activities, whilst taking advantage of sustainable development opportunities. During 2010/11 over 150 businesses attended the workshops, events and training sessions delivered by GBF.

**Key Actions**

- Maintain the Green Business Fife network to support businesses in implementing energy and resource efficiency
- Monitor the change in microgeneration applications following any changes to the FIT scheme, the introduction of the Renewable Heat Incentive Scheme and any further changes in legislation, especially changes to permitted development rights under the Planning etc Act 2006.
ONSHORE WIND

Ambitions and Capacity

In recent years, there has been a significant increase in interest in commercial wind turbine developments in Fife, in both urban and rural locations. These interests must be balanced against the impacts on Fife’s landscape and environment, and the potential unacceptable levels of disturbance which can result from wind turbine developments. Fife Council is actively working with developers to assist in allocating projects to the appropriate Area of Search for Wind Turbine Development as delineated in Local Plans.

In this section, onshore wind developments are categorised as those having a generation rating of 101kW or greater, i.e. greater than that of microgeneration.

Current & Potential Deployment

Planning permission for Fife’s first onshore wind project (rated over 101kW) was lodged with the Council in 2003. Since then activity has been relatively muted until between 2010 and 2011 where interest rose substantially with 29 applications submitted in 2010 and 51 in 2011 as compared to just 4 applications in 2009. Between 1999 and 2011, onshore wind applications (above 101kW capacity) comprised 13% of all renewable energy related planning applications.

In total, there are 30 onshore wind turbines rated over 101kW with planning permission in Fife, of which 22 turbines are part of three consented wind farms:

- Little Raith north of Auchtertool (9 turbines)
- Earlseat east of Kirkcaldy (8 turbines)
- Infinis at Westfield (5 turbines)

To calculate the generation potential of Fife’s onshore wind turbines, data from the British Wind Energy Association (BWEA) highlights that over the whole of 1995 British wind farms operated at an efficiency of 31.3%. Subsequently, the rated capacity of onshore wind turbines in Fife has been discounted to 30% (allowing for potential down time for maintenance) to estimate likely electricity generation.

The likely generation capability (discounting the intermittency of wind) of all approved onshore wind turbines rated above 101kW contribute 19.6MW (165 GWh), which equates to 37% of all Fife’s consented renewable electricity generation.

The approval of any onshore wind applications will always be assessed using planning guidance outlined in the Fife Wind Energy Supplementary Planning Guidance (SPG) 2011. Between 1999 and 2011, 5 applications for onshore wind turbines were refused. These had a likely cumulative generation capability (discounting the intermittency of wind) of 14MW (122 GWh) which is enough electricity to power around 28,000 homes.

The potential deployment of onshore wind in Fife can be inferred through applications currently in Fife Council’s planning system that are categorised as ‘pending consideration’ or ‘pending decision’. The estimated likely electricity generation from onshore wind applications with this status totals 20 MW (181 GWh) which (if consented and subsequently developed) could double the total generation capacity of consented

Table 4: Onshore Wind Generation (101 kW+ turbines), 1999-2012

<table>
<thead>
<tr>
<th>Description</th>
<th>Total (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fife’s Total Electricity Consumption (2005)</td>
<td>1,927</td>
</tr>
<tr>
<td>Fife’s Annual Household Electricity Consumption (2005)</td>
<td>743</td>
</tr>
<tr>
<td>Fife’s Total Renewable Energy Developments*</td>
<td>739</td>
</tr>
<tr>
<td>Fife’s Onshore Wind (101 kW+ rated) Developments*</td>
<td>171</td>
</tr>
</tbody>
</table>

Source: DECC and Fife Council Enterprise, Planning & Protective Services

*Note: Includes only developments that are already generating, those that are under construction and those that have received planning permission as at 30th January 2012.
onshore wind energy in Fife. However, as Fife Council has robust Wind Energy Supplementary Planning Guidance it is likely that a proportion of these applications will not be developed.

Appendix 1 outlines where all onshore wind energy developments, either operating, approved or under consideration are located in Fife as at 29 February 2012.

Within the Fife Wind Energy SPG, an area of search outlines where wind developments may, subject to further assessment, be located. As onshore wind developments are approved, the wind energy area of search will have to be reassessed to take account of any cumulative impact.

Appendix 2 outlines the area of search as described in the Fife Wind Energy SPG.

Progress to Date

The nine-turbine wind farm project at Little Raith is a significant addition to Fife’s diverse energy industry. The wind farm will have an installed capacity of 24.75 MW of green energy, with electricity generation likely to average around 7.4 MW (65 GWh) due to variability of wind speeds. This is still enough energy to supply power to around 14,500 homes, which is the equivalent of powering all homes in Cowdenbeath, Lochgelly, Lumphinnans, Auchtertool, Kelty and Ballingry with electricity for a year. Kennedy Renewables acquired Little Raith Wind Farm in September 2010 and is committed to contribute to a community fund for use on local projects within Lumphinnans, Cowdenbeath, Auchtertool and Lochgelly Community Council areas. This community fund, based on the likely electricity generation of the wind farm will provide £49,500 each year and £1.23 million over the lifetime of the wind farm to benefit local communities.

The Earlseat Wind farm is a 20 MW capacity project with anticipated generation to average around 6 MW (15 GWh) due to variability of wind speeds. The development will see eight 120m turbines built near the former colliery by the Standing Stane Road. The £25.3 million Earlseat Farm project is expected to create up to 30 short-term construction jobs, whilst a £1.95 million fund over the development’s 25-year lifespan will create up to 125 apprenticeships following a tie-in with Adam Smith College.

On 20 September 2011 members of Fife Council Planning Committee approved the 5-turbine, 12.5 MW Westfield wind farm, which has an anticipated generation average of around 3.8 MW (9 GWh) due to variability of wind speeds. The wind farm is sited on the former Westfield open-cast coal site near Kinglassie, which will deliver clean renewable energy, create local jobs, deliver a community benefit package and create momentum for the future redevelopment of the site.

Key Actions

The unprecedented increase in the volume of onshore wind applications has presented a number of challenges for Fife Council as a planning authority. To ensure Fife’s onshore wind sector achieves its potential, whilst protecting our natural assets, requires a fine balance. Therefore, the following actions are required to ensure Fife meets its 2020 targets without compromising the value of the Fife landscape or the views of its residents, communities and businesses:

• The area of search and landscape capacity for wind turbine development across Fife will be revised and updated in future reviews of the Fife Wind Energy Supplementary Planning Guidance. This will ensure unacceptable cumulative numbers of turbines are not being reached and the Fife landscape is appropriately protected.

• Early engagement with developers will continue and is essential to provide up-to-date guidance on wind energy proposals.

• Publication of a Community Benefit Guidance Note on Renewable Energy Proposals.
OFFSHORE WIND

Ambitions and Targets

The offshore wind industry within UK waters is predicted to grow to over 5,000 turbines by 2020. This will require massive investment in the full process including turbine manufacture, installation, and operations and maintenance. This presents an opportunity to businesses across the UK and Europe.

There are plans for seven offshore wind farms in Scottish waters. Of those seven, three are likely to be located around 12 nautical miles from the Fife coast and will account for 52% of the total offshore wind capacity in Scotland. The total generation capacity of these three sites is 4,855MW (12,758 GWh). In order to reach that generation capacity, nearly 1,000 turbines (each rated at 5MW) will be required.

Once installed, these turbines will need to be carefully operated and maintained over their lifetime. Operations and facilities located near to wind farms will benefit from reduced time and cost of travelling to the sites. This presents a range of opportunities for companies based close to wind farm sites to carry out scheduled and unscheduled maintenance.

Current & Potential Deployment

Currently, there are no operational or under construction offshore wind farms off the Fife coast. However, the first sites to be developed, pending approval, could see the following scale of projects:

Table 5: Fife’s Offshore Wind Potential

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Number of Wind Turbines</th>
<th>Projected Total Generation Capacity (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch Cape</td>
<td>181</td>
<td>2,378</td>
</tr>
<tr>
<td>Neart na Gaoithe</td>
<td>64</td>
<td>1,182</td>
</tr>
<tr>
<td>Firth of Forth</td>
<td>700</td>
<td>9,198</td>
</tr>
</tbody>
</table>

Source: Crown Estate

The scale and location of the offshore wind developments proposed for installation off the Fife coast is illustrated in Figure 7.

Progress to Date

The construction of offshore wind projects in Scotland is anticipated to begin around 2014 and Fife has already begun to benefit. Fife’s proximity to the offshore sites, its quayside and infrastructure facilities and excellence in manufacturing and engineering capabilities has led to a number of significant investments.

In January 2012, Samsung Heavy Industries announced its intention to base its first European offshore wind project at Energy Park Fife, Methil in an investment totalling £100 million that could create 500 jobs. Samsung plans to test a new 7 MW wind turbine at the Energy Park and, in the future, could start manufacturing there. In addition, David Brown Gear
Systems could potentially set up a supply facility to manufacture the gear boxes for the 7 MW turbines should the prototype prove successful.

Fife firm Burntisland Fabrications (BiFab) diversified into renewables following a management buyout in 2001. The BiFab group has recently emerged as a major contender in the manufacture of offshore wind jacket substructures, diversifying from its traditional roots in the oil and gas industry. Having previously made its name on the SSE/Talisman Beatrice Demonstrator project, BiFab has since supplied SSE’s Greater Gabbard project and has constructed 30 offshore structures for the Ormonde offshore wind project. The company has since won a number of prominent contracts, including a £12 million contract to design and manufacture two substation foundation structures for the Gwynt y Môr offshore wind farm off the North Wales coast and a £4 million contract to construct the Oyster 2 tidal device for Aquamarine Power.

**Key Actions**

Across the offshore wind industry there is currently a drive to reduce the cost of manufacturing, installing and maintaining turbines. In addition, there will be wider effects following the UK Government’s Electricity Market Reform. This will ensure that upgrades to the UK’s electricity interconnection and grid infrastructure can be made to accommodate more renewable energy generation. To maximise the potential of offshore wind in Fife, economic development support will be focussed on supply chain development, including:

- the development of a supply chain programme to support businesses in diversifying into offshore renewables technologies;
- the expansion of existing infrastructure, such as the Phase 3 programme for the development of Energy Park Fife via a Tax Incremental Financing scheme;
- the completion of the Fife Renewables Innovation Centre; and
- the development of the Low Carbon Investment Park at Methil to support business growth from the Energy Park.
ECONOMIC DEVELOPMENT OPPORTUNITIES FOR RENEWABLE ENERGY IN FIFE

Fife is situated close to some of the UK’s largest offshore wind development sites and offers a range of premises and quayside facilities for a variety of renewable energy projects. There are also a wide range of renewable energy skills, courses, qualifications and facilities available in Fife.

Infrastructure

Located on Scotland’s East Coast, the nearest of Fife’s ports with suitable infrastructure is located only 25 nautical miles from the closest of the proposed wind arrays in the Firth of Forth. Fife ports at Methil, Burntisland and Rosyth are experienced in handling a variety of vessels and cargoes and are well placed to play a key role in the development of Scotland’s offshore wind industry.

Energy Park Fife is a flagship development located at Methil Docks. The Park is a joint venture between Scottish Enterprise and Fife Council and is identified within the recently published National Renewable Infrastructure Plan (N-RIP) as being ideally placed to take advantage of the Scottish Government’s commitment to the renewable energy sector. The site also benefits from having a ready association with the offshore wind industry as it is home to Burntisland Fabrications (BiFab). The next phase of the Energy Park project looks to expand the site to include Methil Docks Business Park, Methil Power Station and the dock area. Scottish Enterprise, Fife Council and Forth Ports are developing a masterplan for the waterfront with a focus on opportunities and locations for renewable energy activity. These include manufacturing, operations and maintenance, demonstration, and facilitating business growth.

Extending to some 17 acres, Methil Docks Business Park already has two considerable renewable energy projects under development; the Hydrogen Office and the Fife Renewables Innovation Centre. The Hydrogen Office was established to support the accelerated development of the hydrogen, fuel cell and energy storage industries in Scotland by improving access to and understanding of the technology; facilitating research...
and development and enhancing educational opportunities. Fife Renewables Innovation Centre is a £3 million development which will create high quality work/innovation space in a low carbon facility. The Centre, extending to approximately 1,400m² over 2 floors, is designed to enable technology and knowledge transfer in renewable technologies, and features individual incubation units and shared research facilities. Methil Docks also has two docks able to take vessels up to 3,000 tonnes.

Skills

The growth in renewable energy has stimulated the need to develop new skills, courses, qualifications and facilities to ensure both job and investment opportunities are not lost due to the lack of an appropriately skilled workforce. Table 6 summarises the range of practical skills development activities being undertaken by a range of Fife’s institutions.

Supply Chain

A Renewables Helpline Service (www.investiniferenewables.co.uk) has recently been implemented to enable local companies with the potential of entering the offshore renewable energy sector to gain expert advice on routes to relevant support and funding.

Fife Council’s Market Development Programme supports a range of companies at renewable energy trade shows and conferences. Recent examples include All Energy 2011; Renewables UK 2011 and the Offshore Wind Supply Chain Conference 2012. In attending these events, Fife companies have been able to exhibit their products, seek investment and win new contracts.

### Table 6: Summary of Renewable Energy Skills Developments in Fife

<table>
<thead>
<tr>
<th>Institution</th>
<th>Development Activity</th>
</tr>
</thead>
</table>
| Carnegie College, Dunfermline | - Developing Energy Modern Apprenticeships  
- Operating the Whitlock Energy Collaboration Centre in Rosyth in partnership with Siemens. This established the UK’s first Wind Energy Apprenticeship scheme  
- Developing Scottish Credit and Qualifications Framework (SCQF) Level 4 courses |
| Adam Smith College, Glenrothes and Kirkcaldy | - Future Skills Centre open - a £17m investment  
- Collaborative Innovative Networks (COiNS) project launched in April 2012  
- Developing accredited courses under the Microgeneration Certification Scheme (MCS)  
- Series of lectures for secondary school pupils to be developed for 2013 |
| Elmwood College, Cupar | - Merging with Scottish Agricultural College but specialising in land-based engineering  
- Developing short courses on sustainability for small and medium-sized enterprises  
- Energy Awareness Week held in March 2012 |
| Fife Council, Kirkcaldy and Methil | - Operating the Renewable Energy Skills Development Centre in Kirkcaldy  
- Providing secretariat for the Fife Renewable Energy Skills Group – a collaboration of public, private and education partners  
- Renewables Awareness Centre opened at Kirkland High School |
| The Hydrogen Office Ltd, Methil | - Currently working in 20 primary schools  
- Working with S3 pupils in collaboration with Adam Smith College on an ‘introduction to hydrogen fuel’ and an ‘eco village’ project  
- Involved with SPARKS project which involves bringing renewable energy materials into schools for education |
Local authorities in Angus, Aberdeenshire, Perth and Kinross, Fife and East Lothian have jointly developed a project to support rural supply chain development opportunities. The project is funded by the European Regional Development Fund. The Councils have recently commissioned a baseline and evaluation study to identify the scope of renewables-related activity already being undertaken by small and medium-sized businesses.

The project also outlines the potential for these businesses to expand and develop into the renewable energy sector, in addition to identifying specific clustering opportunities. The study will also benchmark the strengths and weaknesses of each region; and identify the opportunities and risks as well as the gaps and linkages offered by this rapidly growing sector.

Fife Council has led on the formation of East Coast Renewables - a strategic collaboration of local authorities which aims to maximise the economic growth potential of the renewable energy sector for the East Coast of Scotland. The alliance is currently developing a range of marketing material, including a website (www.eastcoastrenewables.org), which will showcase both the strategic N-RIP ports and the smaller ports and harbours within the region which have the potential to service the offshore renewables sector.

**Emerging Technologies**

There are also a range of emerging technologies that could potentially help reduce Fife’s carbon emissions and, in the long term, contribute to Fife’s renewable energy generation capacity. Prior to 2020, it is unlikely that any of the following technologies will contribute meaningfully to Fife’s renewable energy targets but will be monitored to ensure any benefits are exploited. These technologies include:

- Ground Source Heat
- Geothermal
- Hydrogen, e.g. Installation of refuelling of technology as part of a pilot transportation project
- Wave and Tidal/Marine Energy
- Hydro Electric and Micro Hydro
- Lower Carbon, including:
  - Underground Coal Gasification
  - Coal Bed Methane
  - Mine Water Heating
  - Shale Gas/Fracking
  - Carbon Capture and Storage
## Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaerobic digestion</td>
<td>Anaerobic digestion occurs when organic material is broken down by micro organisms in the absence of oxygen, producing biogas that can be used to power electricity generators.</td>
</tr>
<tr>
<td>Biomass</td>
<td>Organic matter used as a fuel, e.g. wood or agricultural waste.</td>
</tr>
<tr>
<td>CHP</td>
<td>Combined Heat and Power generates electricity whilst also capturing usable heat that is produced in this process.</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide, a greenhouse gas contributing to global warming.</td>
</tr>
<tr>
<td>Export</td>
<td>Electricity generated that is in excess of electricity use and can be sold to an electricity company.</td>
</tr>
<tr>
<td>Feed in Tariff</td>
<td>A policy mechanism for encouraging investment in renewable energy generation, through payments for power generation.</td>
</tr>
<tr>
<td>GWh</td>
<td>Gigawatt hour, a unit of energy equivalent to one gigawatt (1GW, 1,000MW, 1,000,000kW) of power expended for one hour of time.</td>
</tr>
<tr>
<td>Hydro</td>
<td>Hydro, or hydroelectricity, is where electricity is generated through hydropower (i.e. power that is derived from the force of moving water).</td>
</tr>
<tr>
<td>kWe</td>
<td>Kilowatt of electrical energy, equal to 1,000 watts.</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt hour, a unit of energy equivalent to one kilowatt (1kW or 1,000 watts) of power expended for one hour of time.</td>
</tr>
<tr>
<td>Micro-CHP</td>
<td>Micro-scale Combined Heat and Power, at the scale of a single building, where heat and electricity are produced simultaneously. Typically replaces a domestic boiler and produces some electrical output.</td>
</tr>
<tr>
<td>MCS</td>
<td>Microgeneration Certification Scheme - installers must be MCS registered to be able to claim FIT payments for systems generating less than 50 kWe.</td>
</tr>
<tr>
<td>MWe</td>
<td>Megawatt of electrical energy, equal to 1,000 kilowatts or 1,000,000 watts.</td>
</tr>
<tr>
<td>MWh</td>
<td>Megawatt hour, a unit of energy equivalent to one megawatt (1MW, 1,000 kilowatts or 1,000,000 watts) of power expended for one hour of time.</td>
</tr>
<tr>
<td>New build installation</td>
<td>Where a microgeneration technology is installed as part of a new building before first occupation.</td>
</tr>
<tr>
<td>Retrofit installation</td>
<td>Where a microgeneration technology is installed in a building which is already occupied.</td>
</tr>
<tr>
<td>Renewables Obligation</td>
<td>The mechanism that funds large scale renewable electricity generators.</td>
</tr>
<tr>
<td>Solar photovoltaic</td>
<td>Solar photovoltaics (PV) is where electricity is generated by converting solar radiation into direct current electricity using solar panels made up of photovoltaic cells.</td>
</tr>
<tr>
<td>Solar thermal</td>
<td>Solar thermal generates renewably heated water using solar panels (known as “collectors”) fitted at an optimal angle on a roof. Solar heat warms fluid, usually anti-freeze, in the collectors and this is then pumped to heat water stored in a hot water cylinder.</td>
</tr>
<tr>
<td>Stand-alone installation</td>
<td>Where an installed microgeneration technology is not attached to a building and not wired to provide electricity to an occupied building.</td>
</tr>
<tr>
<td>Wind</td>
<td>Wind power is the conversion of kinetic energy from the wind into another form of energy, usually electricity.</td>
</tr>
</tbody>
</table>
Appendix 1: Wind developments operational, approved and under construction in Fife (as at 29.2.2012)
Appendix 2: Area of search for wind turbine development below 20MW
MAP OF RENEWABLE ENERGY DEVELOPMENTS IN FIFE