

Dublin City Council
Comhairle Cathrach Bhaile Átha Cliath



Dublin City Sustainable Energy Action Plan 2010-2020

Version 2.0





Dublin City Sustainable Energy Action Plan 2010 - 2020

Version 2

Report prepared in association with Dublin City Council by

Codema

December 2010

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Covenant of Mayors



An tArdmhéara Eibhlín Uí Bhloin

Lord Mayor of Dublin

Eibhlín Byrne

CORPORATE SERVICES DEPARTMENT
Riann Seirbhísí Corparáideacha

30 MAR 2009

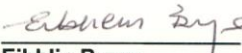
DUBLIN CITY COUNCIL
Comhairle Chathair Bhaile Átha Cliath

Covenant of Mayors

I, **Eibhlín Byrne, Lord Mayor of Dublin** inform you that **Dublin City Council** agreed at the City Council meeting on **2nd March 2009** to mandate me, **Eibhlín Byrne, Lord Mayor of Dublin** to sign up to the Covenant of Mayors, in full knowledge of all commitments, in particular:

- To go beyond the objectives set by the EU for 2020, reducing the CO₂ emissions in our respective territories by at least 20%;
- To submit a Sustainable Energy Action Plan including a baseline emission inventory which outlines how the objectives will be reached, within one year of the above mentioned date
- To submit an implementation report at least every second year following the submission of the Action Plan for evaluation, monitoring and verification purposes
- To organise Energy Days or City Covenant Days, in co-operation with the European Commission and with other stakeholders, allowing citizens to benefit directly from the opportunities and advantages offered by a more intelligent use of energy, and to regularly inform the local media on developments concerning the action plan;
- To attend and contribute to the annual EU Conference of Mayors for a Sustainable Energy Europe

Dublin City
25th March, 2009


Eibhlín Byrne
Lord Mayor of Dublin

Foreword

The Dublin City Sustainable Energy Action Plan 2010-2020 analyses the City's current energy use and carbon dioxide emissions and sets out how the City can reduce its energy consumption through greater efficiency in areas such as residential and commercial buildings, services, industry and transport, along with increasing our share of renewable energy.

This energy plan is fully in accordance with our overall vision for Dublin as a vibrant, innovative economy that develops and attracts world class companies and a socially inclusive city with sustainable neighbourhoods and communities.

As a signatory to the Covenant of Mayors, Dublin City has joined over 2,000 cities and towns in a commitment to the principles of best energy policy, while going beyond the EU targets of a 20 per cent reduction in carbon emissions by 2020. In the specific case of the City Council's own energy use - for public lighting, water pumping, public buildings and facilities and our fleet of vehicles - we intend to be the embodiment of good practice and have set a more ambitious target of 33% reduction over the timescale of this Action Plan.

Residential and commercial buildings are identified as having the biggest opportunity for reducing carbon emissions. Improvements in residential and commercial energy usage will not only make the city more environmentally-friendly but could allow for significant job creation. Through retaining and up-skilling people in the whole area of refurbishment and insulating buildings, there could be a big impact on employment in that sector.

The role that we play as citizens in the way that we use energy at home, in the workplace and in our daily commute is also a critical factor in determining whether the creation of an energy-smart city can be realised, and even a modest change in behavior can have a significant impact.

Looking towards the future, this report identifies a set of concrete actions that puts Dublin on track to becoming a sustainable and energy-smart city. Therefore, it is crucial that we act together to achieve a clean, green, compact and connected city with an innovative smart economy, resulting in sustainable living for our families, our neighbourhoods and future generations to come.



Gerry Breen
Lord Mayor of Dublin



John Tierney
Dublin City Manager

Steering Committee Members

Seamus Lyons	Assistant City Manager, Environment and Engineering Department and Fire Brigade
Michael Phillips	Director of Traffic & City Engineer
Kathy Quinn	Head of Finance
Dick Gleeson	Dublin City Planner
Ali Grehan	City Architect
Michael O'Neill	Executive Manager, Housing & Residential Services
Aidan Maher	Senior Executive Officer, Corporate Services
Margaret Coyle	Senior Executive Planner
Gerry Wardell	Director, Codema

Introduction

Dublin's Vision as an Energy-Smart City

Codema has worked with Dublin City Council in developing this Sustainable Energy Action Plan which analyses Dublin's potential to become an energy-smart city by 2030.

This long-term vision shows how over the next twenty years, the introduction of carbon neutral and low-energy buildings, improvements in information technology and the development of a low-carbon transport system will help Dublin to reduce its carbon emissions by 50 per cent.

For example, retrofitting of the housing market will bring the building energy rating of a typical Dublin home from an E to a C rating, and electricity use will become much more intelligent through the introduction of smart meters.

Dublin's transport sector will also change dramatically as electric vehicles become more common on our city's roads and improved cycleways will make cycling more accessible. Dublin City Council will also continue to increase its use of renewable energy sources for housing and public amenities.

Overall, we are committed to the principles of best energy policy for the creation of Dublin as an energy-smart city.

Covenant of Mayors

The Covenant of Mayors is a commitment by signatory cities and towns to go beyond the objectives of EU energy policy in terms of reduction in CO₂ emissions through enhanced energy efficiency and cleaner energy production and use.

Dublin city signed up to the Covenant of Mayors in March 2009 and the City Council has set itself a target of a 33 per cent reduction in its own energy consumption by 2020. Through this process Dublin is committed to preparing a Sustainable Energy Action Plan (SEAP).



Fig. 1: The Lord Mayor of Dublin Cllr. Eibhlin Byrne signing the 'EUROCITIES Declaration on Climate Change' in Lyons, 27th October 2008. This was in advance of the formal signing of the Covenant of Mayors on 25th March 2009.

The Lord Mayor of Dublin Cllr. Emer Costello has also identified opportunities for urban renewal and job creation through implementation of the sustainable energy measures that are set out in this Dublin Sustainable Energy Action Plan:

'The creation of an energy-smart city will also present huge opportunities for renewal and job creation. In my tenure as Lord Mayor of Dublin, I have established the Lord Mayor's Commission for Employment to focus on job creation and the retention of existing employment. I believe that sustainable renovation and retrofitting will be key factors in stimulating future job growth. For example, Codema has set up the Energy Smart Community scheme which allows homeowners to join together in clusters to improve the energy performance of their homes. The scheme also enables contractors to join an expert panel to tender for these works'.

- The Lord Mayor of Dublin Cllr. Emer Costello, keynote speaker, Covenant of Mayors Ceremony at the Hemicycle of the European Parliament on 4th May 2010,

Context

Dublin City Council is committed to achieving an economic, social and environmentally sustainable Dublin, within its overall vision of a clean, green, compact and connected city with an innovative smart economy and with sustainable neighbourhoods and communities. This is the long-term vision set out in the Dublin City Development Plan 2011-2017.

Objectives

Dublin City Council realises that the current trend of energy consumption within the city is unsustainable and a clear and ambitious plan is needed both to halt and to reverse this trend of rising energy consumption.

In order to develop a SEAP for Dublin City, a baseline of current consumption had to be developed, as none existed at the time, Codema produced a *Baseline Emissions Inventory* (as a separate document). This is a comprehensive analysis of the current (2006) consumption of energy in the city in the residential, transport and commercial sectors. The resulting data was then utilised to form a number of actions in each sector to reduce energy consumption and associated CO₂ emissions.

The overall objectives of the SEAP are to:

- Reduce the economic expenditure on energy for citizens, council and business
- Reduce Dublin's per capita CO₂ emissions
- Reduce Dublin's dependence on imported fuel
- Make Dublin a more competitive and attractive destination for business through modern and efficient energy infrastructure and pricing
- Increase Dublin's share of renewable and sustainable energy systems
- Encourage an environment that fosters and supports wellbeing for its present and future citizens

These objectives fulfil the three criteria of sustainability: economic, environmental and social and the subsequent actions are aimed towards the most sustainable solutions to the current problems.

A '*Climate Change Strategy for Dublin City*', covering the years 2008-2020, was prepared by the Environment & Engineering Strategic Policy Committee of Dublin City Council in association with

Codema. It was adopted by the City Council in May 2008. In the strategy a set of actions was proposed, aimed at reducing Dublin's carbon footprint.

This 'Dublin Sustainable Energy Action Plan 2010-2020' aims to prioritise and elaborate on the main energy-related actions arising from the climate change strategy. This action plan is also aligned with '*Sustainable Dublin – A smart competitive and visionary city*' launched by Dublin City Council in November 2008. Dublin City Council is using '*The Natural Step*' framework to integrate sustainable practices into their work.

Environmental and Heritage Protection

The ultimate aim of the SEAP is to have a positive impact on the environment through the reduction of CO₂ and other pollutants. However the plan is inherently sustainable and as such must be implemented in a sustainable manner with minimal disruption to the existing environment. This will be achieved through the concentration of actions in existing urban developments, utilizing existing infrastructure where possible and focusing on small scale renewable energy production in areas of current generation and in existing developed zones.

The importance of environmental protection and the need to integrate environmental considerations into the preparation of this energy plan are fully recognized.

An *Environmental Report* for the energy action plan has been produced (as a separate document). Due regard is given to the Irish Statutory Instrument S.I. No. 436/2004 – Planning and Development (Strategic Environment Assessment) Regulations 2004, which transposes the EU Directive 2001/42/EC '*on the assessment of the effects of certain plans and programmes on the environment*' (SEA Directive). Particular attention is given to Annex I of the Directive and Schedule 2B of the S.I. regarding *Information to be contained in an Environmental Report*'. The environmental report will determine what, if any, mitigation measures need to be addressed regarding the actions of the SEAP. The SEAP will incorporate any mitigations that are required to ensure the most sustainable approach possible.

An important issue in environmental protection is the consideration of any existing environmental problems which are relevant to the plan including, in

particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to the Wild Birds Directive (79/409/EEC) or Habitats Directive (92/43/EEC). In this respect, the guidance document on *'Appropriate Assessment of Plans and Projects in Ireland'* (NPWS, DEHLG, December 2009) is followed and the SEAP has undergone an Appropriate Assessment screening.

This report is also fully in accordance with the *National Energy Efficiency Action Plan 2009-2020* (NEEAP) *'Maximising Ireland's Energy Efficiency'*, and the *'National Renewable Energy Action Plan'* (NREAP) published by the Department of Communications, Energy and Natural Resources, pursuant to the EU *'Energy End-Use Efficiency and Energy Services Directive'* (2006/32/EC) and the EU Directive on the *'promotion of the use of energy from renewable sources'* (2009/28/EC), respectively.

Similarly no action will be encouraged through this SEAP that will have an adverse and irreversible impact on any identified or potential archaeological, architectural or heritage sites. All actions will endeavor to avoid such situations by concentrating on areas of existing urban development and will adhere to all relevant legislation and assessments.

Process

This *'Dublin Sustainable Energy Action Plan 2010-2020'* first reviews the potential for reducing Dublin City's carbon footprint along with the associated capital costs of the measures and the resulting energy cost savings. It then sets out a schedule of concrete actions that have been carried out since the baseline year 2006, or are planned for implementation in the future period up to 2020.

The SEAP incorporates a variety of actions, some are part of the national process such as Transport 21, others are citywide and the rest will be for the Council's own activities. All come under the umbrella heading of a SEAP for Dublin City

A *Baseline Emissions Inventory* for Dublin, which forms a pre-requisite for this action plan, was published in September 2008. It sets out the 2006 energy and emissions baseline under four headings: residential, services, manufacturing and transport sectors.

As already discussed, the importance of environmental protection is fully recognised and an *Environmental Report* and *Appropriate Assessment Screening* have been prepared.

Throughout this process, Codema has worked with the Joint Research Centre (JRC) - Institute for

Energy (IE) and Institute for Environment and Sustainability (IES) - of the European Commission, which has been assigned the task of scientific and technical support to the Covenant of Mayors.

The *'Dublin Sustainable Energy Action Plan 2010-2020'* therefore follows the EU guidelines *'How to develop a Sustainable Energy Action Plan (SEAP) – Guidebook'* (Publications Office of the European Union, 2010)

The results of the *Baseline Emissions Inventory* as well as the key elements of the SEAP are summarised in the EU SEAP Template that is uploaded online to the Covenant of Mayors Office (see Appendix I).

Consultation

Consultation with stakeholders has been an important part of the process, from the start and the first step in developing this report was the *Dublin Seminar on Sustainable Energy Action Plans* at the Civic Offices in October 2006. This brought together experts, stakeholders and decision makers from Dublin, along with the partners in the EU 'SECURE' project from Denmark, Sweden and Estonia.

Next, pre-draft consultations with key stakeholders and the general public were facilitated over the following months. Fifty organizations were consulted, including Dublin City Council and Government Departments and agencies, business associations, engineering consultants, education and research institutions, local Residents' Associations and the youth organization - Comhairle na n'Óg.

A first draft of this *'Dublin Sustainable Energy Action Plan, version 1.1'* was approved by the Environment & Engineering Strategic Policy Committee in May 2009 and noted by the meeting of City Council in June 2009, prior to the finalization of the EU SEAP Guidelines.

A formal public consultation process was carried out, in which copies of the 3 documents:

- Dublin Sustainable Energy Action Plan, version 1.1
- Baseline Emissions Inventory
- Environmental Report

were made available on the Dublin City Council and Codema websites and hard copies were displayed in the Civic Offices foyer over the six-week period up to 23rd April 2010. Through a newspaper advertisement the general public was invited to submit comments that have been taken into account in this revised *'Dublin Sustainable Energy Action Plan, version 2'*.

Overview of Measures

This report examines sustainable energy actions both in terms of (a) their potential to reduce the city’s carbon footprint and (b) the cost of the measures.

When the measures are arranged in ascending order according to the **net cost per tonne of CO₂ abated**, those measures that require a net investment are represented by the (blue) bars above the zero axis in Figure 2, while those that represent a net saving appear (green) below the axis.

It follows that the economically most attractive measures are to the bottom-left of the chart, while the most expensive measures are at the top-right.

If all of the measures are fully implemented the total saving is 65 TWh primary energy over the 12-year period 2008-2020 and the corresponding total carbon abatement is 14 million tonnes CO₂.

These amounts represent on average 24% annual saving of 5.4 terawatt-hours (TWh)/year of energy and 1.2 million tonnes CO₂/year, respectively.

Half of the measures, if fully implemented, (those below the axis in fig. 2) will actually show a profit of €1.65b over the 12-years period and will also reduce Dublin’s carbon footprint by 12.2%.

Carbon Abatement Costs

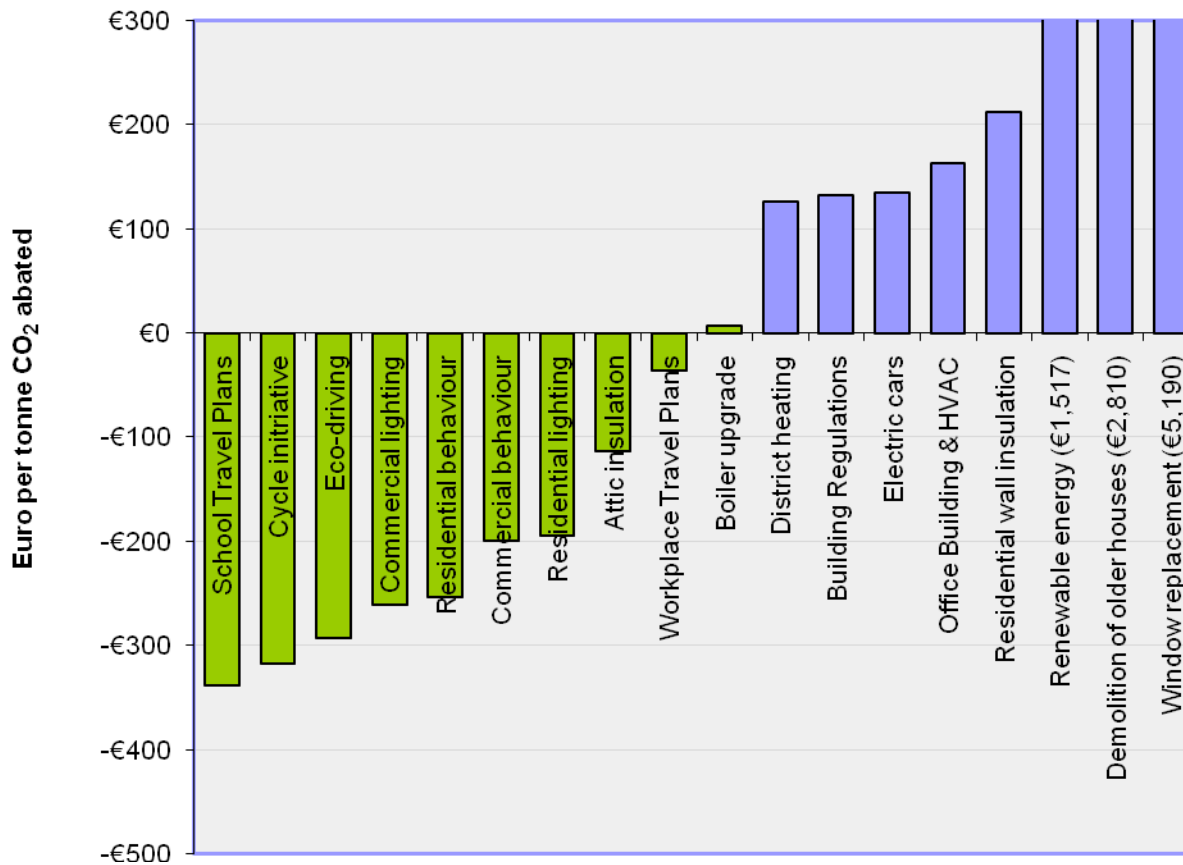


Fig 2: Carbon abatement net costs per tonne CO₂ abated (2010-2020)

Summary of Costs

The estimated investment for all the measures listed in figure 2 is a total of €6bn (0.5bn/year) and the cost saving, based on 2006 energy tariffs and a carbon price of €25/tonne, is a total of €3.6bn (€0.3bn/year); therefore, the net total cost is €2.4bn (€0.2bn/year). However, selective investments can be more cost-effective:

- Three of the 18 measures listed: renewable energy, demolition of older houses and window replacement, while important in the long term, do carry a very high carbon abatement cost

- The remaining 15 measures will capture 91% of the total carbon abatement potential at just 40% of the investment cost, with a net financial gain of €1bn over 12 years

- As already mentioned, half of the measures, representing approximately 50% of the identified potential, will pay for themselves over the 12-year period. The investment required for these self-paying measures is €420m (€35m/year), but this will be fully recouped, with profit, through the energy saved by 2020

It is noted that these cost estimates do not take into account future changes in the prices of energy and of carbon, which are difficult to predict. Neither do they take into account the cost of finance. Both of these factors can have a significant impact on the economic model.

Opportunities in Buildings

Residential and commercial buildings account for 55% of total CO₂ emissions and represent the biggest possible opportunity for CO₂ abatement in Dublin. The per capita emissions for Dublin's buildings is 5.36 tCO₂/capita/yr, which is high compared with other cities in a similar climate. There is thus considerable scope for improvement of the energy performance of Dublin's buildings.

Extra insulation, boiler replacement and CFL light bulbs combined can save 6.5 m tonnes CO₂ over the next 12 years, equal to just over 0.5 m tonnes CO₂ per year – or about 10% of Dublin's total emissions.

It is relatively inexpensive to include extra insulation and more energy-efficient equipment at the design and construction stage of a building but much more costly to retrofit into existing buildings. For this reason Dublin City Council has, through a variation to the City Development Plan, specified high energy standards in all new residential and commercial building developments.

Changing Behaviour

The end-user has a very important role to play in the way energy is used and especially in behaviours to improve energy efficiency through avoiding unnecessary waste of energy.

The way people use energy in the home, at work and in commuting between the two places, has the potential to save up to 20% of total energy consumption. Even if this full potential is not captured, savings of 5% to 10% are readily achievable without any compromise in the quality of lifestyle.

Promotional campaigns to encourage citizens to use energy more efficiently can be effective, for example, by switching off lights, TVs and computers when not in use and where possible by using more sustainable forms of transport such as public transport, walking and cycling.

Sustainable Infrastructure

In order to meet the tough long-term emissions targets, deeper cuts in carbon emissions requiring major infrastructure developments over a longer time-span of, say 50 years are called for. These include:

- renewable energy
- smart electricity grid and metering
- district heating and cooling
- additional rail-based public transport

While the short-term return from this major investment might appear small in the initial years, its development is essential for the necessary transition to a low carbon economy and, critically, its implementation must start immediately.

District heating (DH) offers great potential for more efficient heating of Dublin's buildings, through utilising waste heat produced in generating electricity and opening up the potential for renewable energy sources. While the initial capital costs are high – in the region of €40 m for Phase 1 of the proposed Dublin District Heating project, the savings and other benefits will continue over the long term.

It is estimated that an extensive DH network has the potential to reduce the consumption of primary energy in buildings in Dublin by up to 30%.

Current Situation

Dublin City currently consumes 22.0 TWh of primary energy per year, equivalent to 1.9 million tonnes of oil, in the form of electricity, oil, natural gas and renewable energy (2006 data). In the process, the city emits approximately 5 million tonnes of the greenhouse gas carbon dioxide (CO₂), which represents 9.7 tonnes CO₂/capita/year.

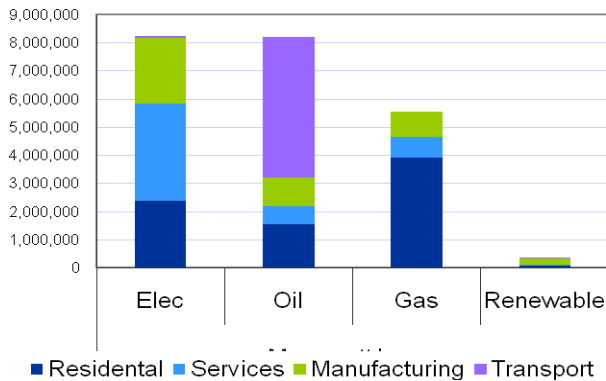


Fig 3: Current Energy Consumption for Dublin City. Total consumption is 22.0 TWhr primary energy per year (2006 data)

Due to the technical fact that different types of fuel have different carbon intensities (i.e. they emit CO₂ at different rates), the CO₂ ratios are not identical with the energy consumption ratios, as the mix of fuels is not the same across all the sectors.

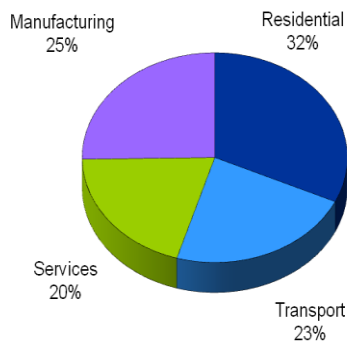


Fig 4: Current CO₂ emissions from energy consumption in Dublin City, by sector. Total emissions are approx 5 million tonnes CO₂ per year (2006 data)

DCC's Own Energy Use

Dublin City Council in its own operations, for offices, public lighting and traffic lights, water pumping and fuel for its fleet of 1,400 vehicles, consumed 0.47 TWh of primary energy per year (2006 data). This represents 2.1% of the total Dublin City energy consumption.

In 2006 the cost for this energy use amounted to €15.8 m, (representing €1,800 per hour for every hour of the year). The energy budget for 2007 was 23% higher at €19.5 m.

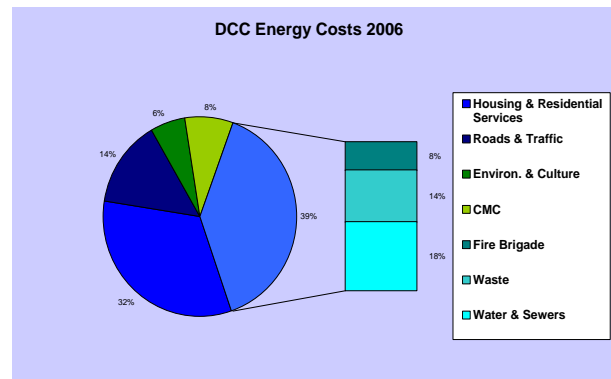


Fig 5: Dublin City Council's own energy consumption cost €15.8m in 2006

Renewable energy now accounts for 19% of the Council's own energy use:

- Methane (itself a powerful greenhouse gas) is recovered from the Poolbeg waste-water sludge treatment plant and used to generate 4 MW of electrical power, plus heat for running the plant
- A 90kW water turbine at the Roundwood Water Works supplies the energy needs of the works, and exports the surplus electricity
- Five 50 kW wind turbines at Fr. Collins Park are used to power the sports, lighting and water aeration facilities
- In addition, the Council is installing solar panels for hot water on the roofs of its social housing and CHP units for a number of its public buildings.

Identified Potential

The potential for CO₂ abatement in Dublin City, summarized in Table 1, has been assessed in detail in the accompanying report 'Baseline Emissions Inventory' (September 2008).

The overall approach to this work follows the principles of Human Development and Capability, as set out by the United Nations – because climate change is essentially about people and human development worldwide.

In the methodology, energy consumption is evaluated for the four main sectors: residential, services, manufacturing and transport. Models specific to the Dublin situation have been created

from first principals for each sector, (rather than simply using existing models from other cities).

The standard emissions factors used in the calculations are in line with the Intergovernmental Panel on Climate Change (IPCC).

Table 1 lists the measures that have been evaluated, along with the basic data, expressed as the total quantity over the 12-year span from 2009 to 2020.

Figure 6 in the next section derives from Table 1; the annual average being a simple division of the 12-year total by a factor of 12. (It is noted that this under-represent the year-2020 CO₂ abatement for the longer-term measures such as district heating)

Sector	Measure	Primary	CO ₂	Cost	Total	Invest-	Abate/ Invest Ratio
		Energy Saving	Abate- ment Potential	Savings	Invest- ment	ment Less Cost Savings	
		TWh	Mt CO ₂	Million €	Million €	Million €	kgCO ₂ /€
Residential	Refurbishment:						
	▪ Low-energy lighting	1.40	0.38	88	14	(74)	2.7
	▪ Attic insulation	4.36	0.80	188	96	(91)	0.8
	▪ Wall insulation	7.09	1.30	266	543	278	0.2
	▪ Boiler upgrade	11.57	2.14	410	424	14	0.5
	▪ Window replacement	1.99	0.37	70	1,975	1,905	0.0
	▪ Renewable energy	0.62	0.78	106	1,296	1,189	0.1
	District heating	0.41	0.15	24	43	19	0.3
	Demolition old houses	0.57	0.12	29	355	326	0.0
	Building Regulations	4.98	0.95	221	347	126	0.3
User behaviour	11.69	2.29	617	37	(580)	6.2	
Commercial	Low-energy lighting	4.40	1.05	290	15	(275)	7.0
	Building fabric HVAC	3.80	0.89	250	396	146	0.2
	User behaviour	5.70	1.32	369	107	(262)	1.2
Transport	Workplace Travel Plan	0.90	0.22	24	16	(8)	1.4
	School Travel Plans	0.12	0.03	12	3	(10)	1.1
	Cycle initiative	3.09	0.76	330	88	(242)	0.9
	Eco-driving	1.46	0.36	150	44	(106)	0.8
	Electric cars	1.16	0.32	181	223	43	0.1

Table 1: Identified CO₂ abatement potential, cost savings and costs for measures in residential, commercial and transport sectors; totals for 12-period 2008 - 2020

CO₂ Abatement Cost

In order to generate a marginal carbon abatement cost curve (see Fig 2) the CO₂ abatement potential is combined with the net abatement cost.

Referring to fig. 6, the measures which have a high abatement potential and a low or negative net abatement cost are clearly the most attractive from an economic viewpoint, as they can save money.

The net abatement cost is defined as the total investment less the cost savings from reduced energy consumption, expressed as an annual average over the 12-year period 2008 to 2020. It is

calculated as the simple payback and does not include the cost of finance (e.g. interest etc. on loans).

The energy costs are calculated at 2006 energy rates and a CO₂ price of €25/tonne. They do not take into account future changes in the prices of energy and of carbon, which are difficult to predict and could be significant.

A sensitivity analysis, to examine the impacts of future energy and carbon prices and the cost of finance, are not included in the present report and may need to be reviewed, in due course.

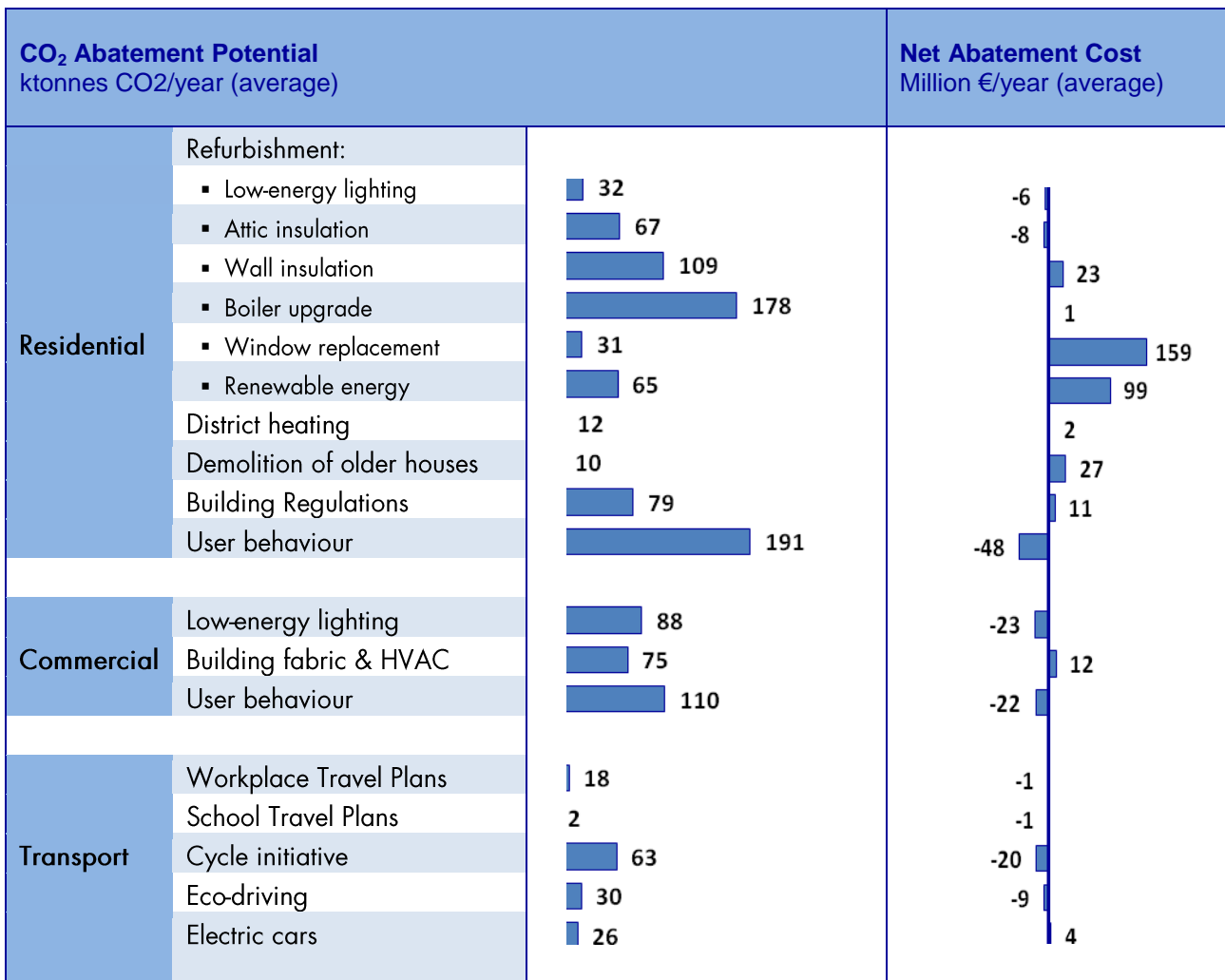


Fig 6: Annual CO₂ abatement potential and net abatement costs for measures in residential, commercial and transport sectors, expressed as the average over the 12-year period 2008-2020

Targets

The UN Intergovernmental Panel on Climate Change (IPCC) has determined that the developed countries of the world will need to reduce their CO₂ emissions by 80% by the year 2050 in order to stabilize the Earth's temperature at +2°C compared with today and to avoid disastrous consequences.

It is a very challenging target that is estimated to cost 1% to 2% of GDP, but the cost of not taking any action is likely to be many times higher.

Ireland's legally binding target within the EU is a reduction of at least 20% in emissions by 2020, relative to 2005, for the 'non-traded sectors', (i.e. outside heavy industry and electricity generation). The target for the Public Sector has been set in the National Climate Change Strategy at a higher level: 33% reduction by 2020

In relation to Dublin, the UN target equates to approx. 2 tonnes CO₂ per capita per year by 2050, which is extremely challenging because in practice such a large step has major impacts on the way people live and do their business. It may be more convenient for planners to view the strategic options in terms of short-term and long-term measures, which are easier to influence.

Thus, there can be short-term measures (on say a 12-year time scale) that can have the potential to reverse the current upward trend in CO₂ emissions. They can also play a major role in meeting the Irish and EU target of 20-30% reduction by 2020.

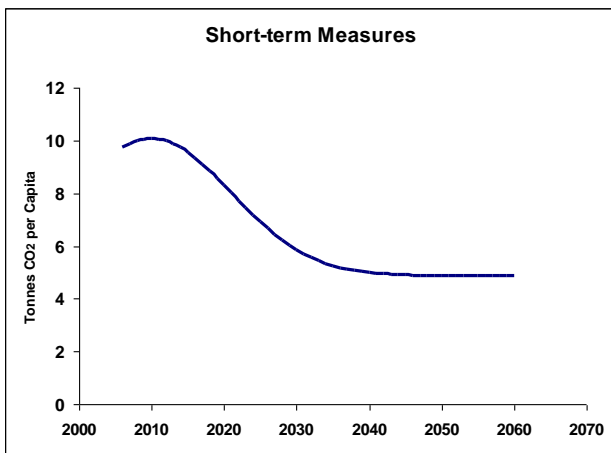


Fig 7: Short-term measures can be represented by a bell-shaped (Gaussian) curve to accommodate the current level and rising trend of emissions.

These short-term measures include insulation of existing buildings and replacing the old inefficient boilers with more efficient systems and more efficient and smarter lighting in our homes and offices.

Where it is possible to do so, changing work practices and modes of transport can have a significant impact on CO₂ emissions; for example, less dependence on single occupant car for commuting to work, along with more car-sharing, public transport, walking and cycling.

These short-term measures represent what is often termed 'the low hanging fruit'. But in order to meet the tough 2050 emissions targets a greater investment, requiring major sustainable infrastructure (district heating, Transport 21 and renewable energy) developments over a longer time-span of, say, 50 years is called for.

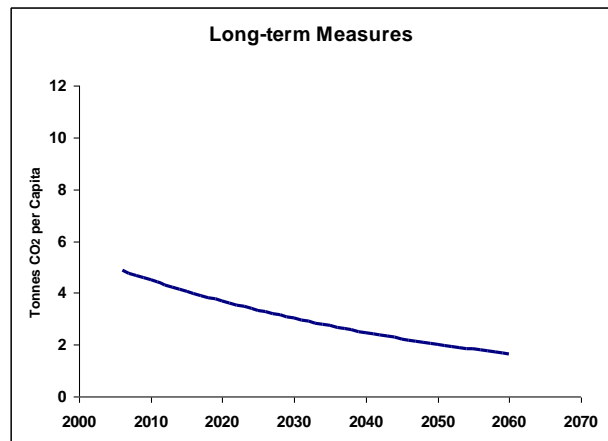


Fig 8: Long-term measures can be represented by an exponential curve, because the closer it approaches zero the more difficult it becomes to make further reductions

While the year-to-year return from such major investment appears small, the accumulated benefit over the long life of the infrastructure is great.

The long-term development of sustainable infrastructure is central to Dublin's future transition to a low carbon economy and, critically, its implementation must start without delay. This is the inheritance that the present generation passes on to the next.

Scenarios

Against a ‘Business-as Usual’ (BAU) baseline and trend-line for Dublin, the measures outlined in this action plan can be divided into two general scenarios.

■ **Scenario 1** can be implemented in the short-term to effectively reverse the current upward trend in emissions; these are often described as ‘the low hanging fruit’.

Potential: 13% CO₂ reduction by 2020

■ **Scenario 2** includes Scenario 1, but is more ambitious, requiring major changes in practice, extensive introduction of new technologies and significant financial investment.

Potential: 27% CO₂ reduction by 2020
(including 13% of Scenario 1)

Added to these are the contributions from new sustainable infrastructure: Dublin District Heating project, Transport 21 and renewable energy, particularly electricity from wind, waste, solar and water.

Sustainable Infrastructure

■ **Dublin District Heating project.** Phase 1 has an identified potential saving of 0.15 Mt over the 12-year period to 2020, mainly in the residential sector included in Scenario 2. (See later section for further details on DH)

■ **Transport 21** T21 includes two new Metro lines, Rail interconnector from Heuston to Connolly, and extensions to the LUAS and DART, and will give an estimated 0.21 Mt CO₂ reduction per year.

Potential: 4% additional CO₂ reduction by 2020

■ **Renewable Electricity** Ireland’s Target is for 40% renewable contribution to the national grid by 2020, which will further reduce Dublin’s carbon footprint.

Potential: 10% additional CO₂ reduction by 2020

In conclusion, these combined measures have the potential to reduce Dublin’s emissions to 6.65 tonnes CO₂/capita/yr, a 40% reduction by 2020. (see Fig. 8).

Sector	Scenario 1: Actions	Scenario 2: Additional Actions
Residential	<ul style="list-style-type: none"> ■ Improve user behaviour ■ Low energy light bulbs ■ Attic insulation in existing homes ■ All new houses to be ‘A’ energy rated on BER scale 	<ul style="list-style-type: none"> ■ Major refurbishment of existing houses, including wall insulation, energy efficient windows, high efficiency boilers and renewable heat ■ District Heating phase 1, with renewable energy sources
Commercial	<ul style="list-style-type: none"> ■ ‘Good housekeeping’ (e.g. switching off equipment not in use) ■ Low energy lighting systems and controls 	<ul style="list-style-type: none"> ■ Upgrade of heating, ventilation and air conditioning ■ Insulation of the fabric of existing commercial buildings ■ All new commercial buildings over 1,000 m² to be ‘A’ energy rated
Transport	<ul style="list-style-type: none"> ■ Workplace travel plans for commuters ■ School travel plans ■ Cycle initiative 	<ul style="list-style-type: none"> ■ Eco-driving training for professional drivers of buses, trucks and taxis ■ Electric cars (including plug-in hybrids) at 10% market penetration

Table 2: Summary of energy actions for Scenarios

Meeting the Targets

The short-term and long-term measures, already discussed, can be combined together into an overall trajectory from 2006 to 2060. There is a span of possible trajectories that will meet the UN target (of 80% reduction) for 2050, allowing Dublin to make a proportional contribution towards stabilizing the Earth’s climate. Outside this envelope, Dublin will not meet the targets, given our starting position.

It is clear from fig. 9 that Business As Usual (BAU) is not an option and that Scenario 1 (the low-hanging fruit) will keep the City on track only up to 2014.

It is equally clear that an additional major investment in infrastructure is required to meet the Irish and EU commitment for 2020 and the UN 2050 target.

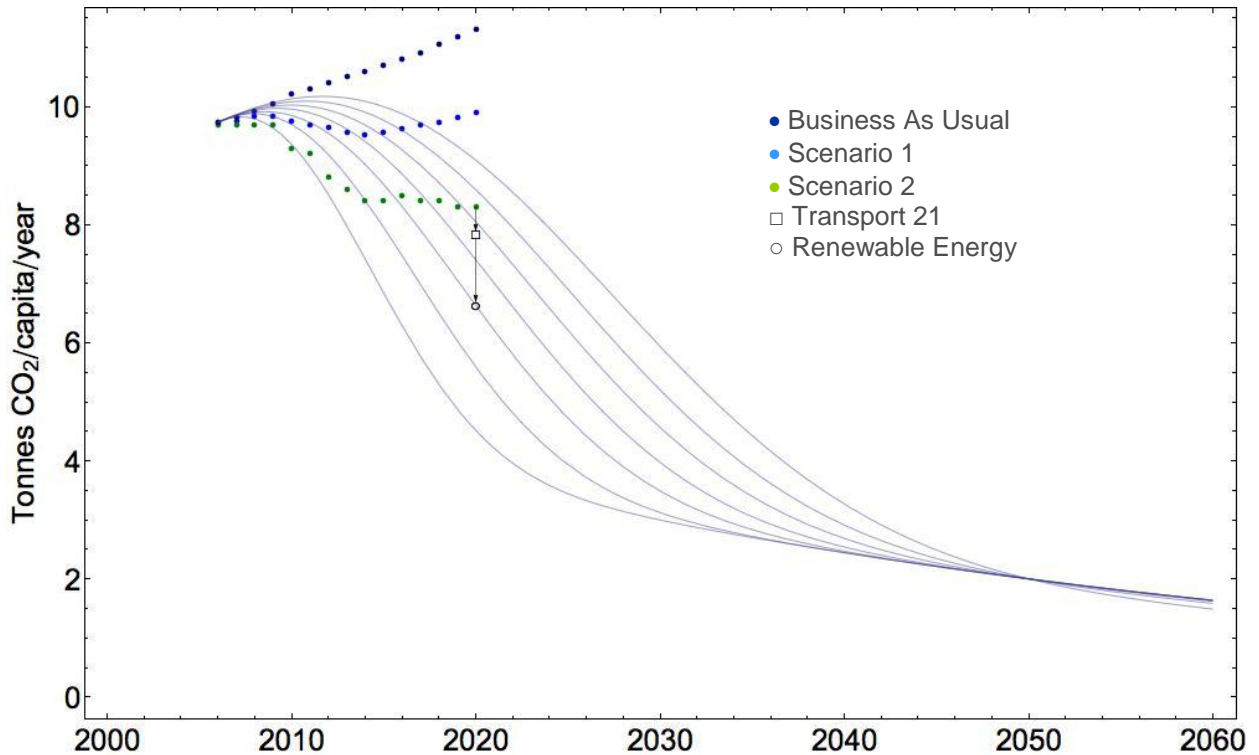


Fig 9: Trajectories of CO₂ emissions abatement for period 2006 to 2060

Schedule of Actions

The measures and instruments that are set out in this section focus on the areas that are under the direct control of the local authority, or at least within the Council's sphere of major influence. They are considered under the four main headings: regulatory, fiscal, behavioural and technological.

Within the categories, a number of examples are included to illustrate the type of practical actions that have been carried out since the baseline year, 2006, or are planned for the near future.

Regulatory Instruments

Dublin City Development Plan 2011-2017:

The City Development Plan is a 6-year strategic plan that aims to ensure that the right developments occur in the right places. It is made by the Elected Members in consultation with citizens and stakeholders in the city.

The approach taken in the new Dublin City Development Plan, 2011-2017, differs from the previous development plans. The new approach looks beyond the next six years and sets out a longer-term vision of Dublin twenty years from now.

The vision of Dublin in 2030 is founded on the dual ideas of sustainability and quality of life:

“Dublin 2030’ is a compact city, with a distinct character, a vibrant culture and a smart, innovative economy. It’s a city of urban neighbourhoods, connected by good public transport and green spaces. In 2030, Dublin is one of the most sustainable, dynamic and resourceful cities in Europe.

-Draft Dublin City Development Plan 2011-2017

The new approach is more strategic in nature than previous development plans and, in pursuing its long-term vision, the Council has begun by identifying a number of core strategies that can be reached by 2017, including a strategic approach to sustainability that encompasses climate change, energy efficiency, renewable energy and transport.

This new City Development Plan 2011-2017 will come into effect from January 2011 and will then supersede the current development plan.

Energy Standards for New Buildings

Variation 22, Dublin City Development Plan 2005-2011 (5th November 2007):

Policy Residential 20:

‘That Dublin City Council will seek to promote more sustainable development through energy end use efficiency, increasing the use of renewable energy, and improved energy performance of all new building developments throughout the City. This policy objective will be achieved by:

- Encouraging responsible environmental management in construction;
- Promoting sustainable approaches to housing developments by spatial planning, layout, design and detailed specification;
- Ensuring high standards of energy efficiency in all housing developments and encouraging developers, owners and tenants to improve the environmental performance of the building stock, including the deployment of renewable energy;
- Through the phased introduction of a performance based Building Energy Rating (BER) target for all new building developments greater than 10 dwellings or greater than 1,000 sq.m floor area for non residential and mixed developments.’

Paragraph 15.9.20 Energy Efficiency

‘In accordance with Policy Residential 20, the Building Energy Rating (BER calculated using the Dwelling Energy Assessment Procedure, ref. www.SEAI.ie) target shall require a collective (per sq.m) average BER rating of at least B1 (on a scale of A to G), effective from 1st January 2008 for residential developments greater than 10 dwellings and effective from 1st July 2008 for non residential and mixed developments greater than 1,000 sq.m floor area.

The BER target shall further require a collective (per sq.m) average BER rating of at least A3, effective from 1st January 2009, for all new building developments greater than 10 dwellings or greater than 1,000 sq.m floor area for non-residential and mixed developments.

Accordingly it will be a requirement that all planning applications submitted to the planning authority after 1st January 2008 include a statement from a competent and qualified person certifying that the proposed development conforms with the energy rating outlined above.’

Fiscal Incentives

Congestion charges: The costs, benefits and effects of congestion charging may be assessed, especially in terms of greenhouse gas emissions. This charge will possibly be introduced before the completion of Transport 21

Free parking for electric vehicles: New generation electric hybrid vehicles are cleaner and more energy efficient than conventional petrol/diesel units. On the issue of Dublin City Council providing free parking for electric vehicles, there is a need to clarify existing legislation on assigning individual parking bays for charging electrical vehicles and to examine the costs and benefits of introducing widespread charging facilities for electric vehicles

National and EU incentives: There is a variety of grants available under national and European programmes that support specific local sustainable energy projects, helping to deliver Irish and EU policy objectives for energy and climate change. For example, the National Development Plan, Sustainable Energy Ireland (SEAI) grants for energy efficiency and EU programmes managed by the Executive Agency for Competitiveness and Innovation (EACI), the European Investment Bank ELANA technical assistance and the INTERREG programme

Behavioural Measures

As already identified in the introduction, the way people use energy in the home, at work and in commuting between the two places, has the potential to save up to 20% of total energy consumption.

In this respect Dublin City Council is leading by good example through initiatives such as their Workplace Travel Plan, the Sustainable Office project, and the 'MINUS 3%' project (see box opposite).

Switch-Off Campaign

Dublin City Council employees are being encouraged to 'Switch-Off' as part of the Minus 3% campaign, an initiative that was launched recently by project co-ordinator Codema.

By switching off everyday office appliances such as computers, photocopiers and light switches when they are not needed, employees could save thousands of Euros on their Department's annual energy bill – money that could be better spent on staff resources.

The Sustainable Office

The Finance Department of Dublin City Council has initiated a sustainable office campaign for the department's offices. It is working to improve its sustainability in paper use, recycling waste, energy, procurement, water and staff travel through a process of benchmarking, actions and review.

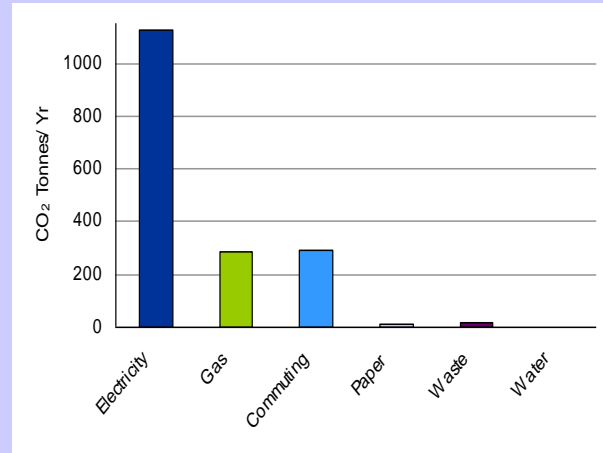


Fig 10: Carbon Footprint of the Finance Department

The total emissions of the Finance Department was 1,719 tonnes CO₂ for the year 2008; this amounts to 4.02 tonnes CO₂/per employee. The Carbon Footprint will be reviewed on an annual basis and efficiency measures are being put in place to reduce the footprint.



The aim of the MINUS 3% project is to demonstrate a 3% per annum reduction in Dublin City Council's own energy consumption, with a long-term goal of 33% by 2020.

The areas that the Council is directly responsible for include heating and lighting of buildings, street lighting, water and waste water services and the Council's own vehicle fleet.

Along with Dublin there are five other cities involved in the project, with Codema as lead partner. The project is supported by the European Commission under the 'Intelligent Energy Europe', programme and runs from October 2008 to September 2011

Technological Measures

New Buildings

The recent variation to the Dublin City Development Plan 2005-2011 (as already described), and the current Irish Building Regulations both require a high energy performance standard in all new residential and commercial building developments.

While such measures incur an initial cost premium, there will be a major net cost saving over the 50+ year's life span of the buildings.

The higher energy standards in new buildings are regulated by local authorities through the Planning Application process and through Building Control.

Dublin City Council is leading by good example in the Council's own major social housing schemes in Ballymun Regeneration and Fatima Mansions, where the energy and environmental specifications are well in excess of normal practice for the industry.

In addition, a number of innovative and very high specification projects, such as at York St. and Raleigh Square (see box), are being built by the Council. These, supported by 'The House of Tomorrow', and other national programmes, serve to demonstrate future possibilities for improved energy and sustainability standards in housing.

Carbon Neutral Housing, Raleigh Sq., Dublin 12

Raleigh Square is a new Senior Citizen scheme comprising 26 residential units which are being designed by City Architects to a carbon neutral specification.

Construction of dwellings to the passive house standard significantly reduces the heating demand and increases the thermal comfort of the dwelling. This will also require a much smaller central heating plant.

It is proposed that a biofuel CHP plant be used to power a community heating system with backup provided by condensing gas boilers.

Electricity produced on site by a biofuel CHP is both very efficient and zero carbon. The CO₂ saved by displacing standard grid electricity compensates for the CO₂ produced by the gas boilers at peak loads.

Predicted BER rating: A2 (50 kWh/m²/yr)
Predicted CO₂ Emissions: 0 tonnes CO₂/yr

Sustainable Housing, York St., Dublin 2

The redevelopment of York Street, off St Stephen's Green, includes 66 new Council apartments arranged in five blocks.

Their low-energy design, by Séan Harrington Architects, addresses the issues of sustainability in building design. The development is constructed to achieve a high level of thermal efficiency with highly insulated building fabric and optimising passive solar gains through south facing glazed balconies.



Fig 11: Dublin City Council housing at York St., Dublin 2

Each block has a group heating system with individual apartments fitted with heat exchangers and heat meters to accurately measure and bill individual energy users.

The heating system consists of solar panels for hot water, backed up from highly efficient condensing gas boilers at peak load. A target of 51% reduction in energy and CO₂ emissions was set at the outset of the design.

As a sustainability measure the timbers from the original floor joists in the demolished building were salvaged and reused as part of the new roof structure. Rainwater from the main roofs is collected for use in the gardens, to conserve water and reduce flooding.

A smaller mews development to the rear is constructed in brick and timber with lime render finish to the external walls. Green roofs are also incorporated, helping to restore the vegetated footprint that was lost when the original buildings were constructed.

BER rating: A3-B2 (avg.92 kWh/m²/yr)
CO₂ Emissions: 1.18 t CO₂/yr/unit

Existing Buildings

As already identified in the introduction, residential and commercial buildings account for 55% of total CO₂ emissions and represent the biggest possible opportunity for CO₂ abatement in Dublin.

The per capita emissions for Dublin's buildings, compared with other cities, is (tonnesCO₂/capita/yr):

Dublin:	5.36
London:	4.3
Tokyo:	2.9
Stockholm:	2.6

There is thus considerable scope for improvement of the energy performance of Dublin's existing buildings.

- Simple insulation of the buildings can alone save 2.5 m tonnes CO₂ over the next 12 years
- An additional 2.5 m tonnes CO₂ can be saved through more efficient boilers and other heating/cooling systems, along with better controls.
- Replacing older light bulbs in the home with efficient CFLs, along with more efficient and smarter office lighting can save a further 1.5 m tonnes CO₂.

These measures are very cost effective (see Fig. 12)

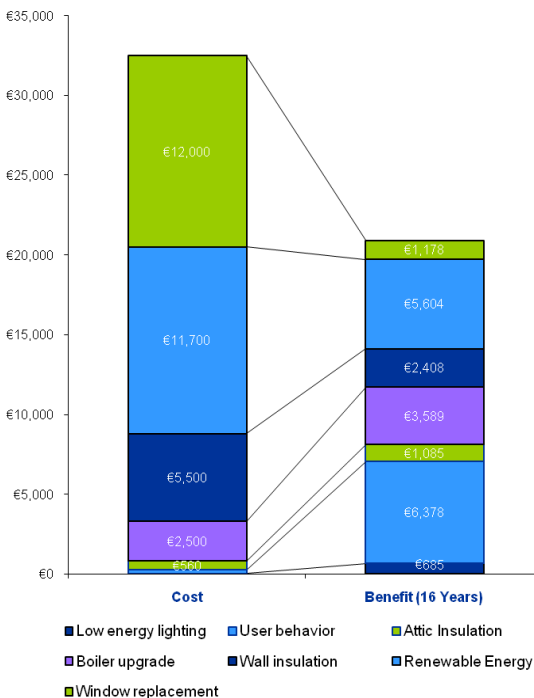


Fig 12: Typical costs and benefits for a domestic retrofit

Energy Smart Community project (2008 -)



The Energy Smart Community is a not-for-profit scheme which allows Dublin homeowners to join together to improve their homes' energy-efficiency at a lower price than going it alone. The scheme works on the simple principle that by bringing homeowners together in a cluster, they can save on the cost and hassle of carrying out energy-efficiency improvements through a group tender process.

The project involves a number of key partners. The lead partner is Codema, responsible for project management and co-ordination, and ESD Training, responsible for community relations and marketing. Once the community cluster is formed and the full specification of works developed, contractors will be invited to tender for the works. Therefore, by joining an Energy Smart Community, homeowner get work carried out at the lowest price possible by contractors of the highest standard that have been thoroughly vetted by Codema.

As part of the Energy Smart Community process, Codema will provide the homeowner with independent energy advice and will act as facilitator between the homeowner and the contractor throughout the entire process, removing any hassle or complication for communities involved.

The Energy Smart Community aims to promote environmental living in a way that makes financial sense and encourages social interaction. The project has the potential to significantly improve the energy efficiency of Irish housing stock, reduce energy use and lower greenhouse gas emissions.

In a time of declining new build within the construction sector, retrofitting and refurbishment offers a valuable opportunity for new job prospects in the construction sector.

Social Housing

One in seven dwellings in Dublin is owned by Dublin City Council, amounting to a total of 26,500 units.

The City Council has for many years been concerned about the risk of fuel poverty among its residents and the Housing Department has already taken steps in the 1990s to successfully eradicate fuel poverty, to a large extent, through gas-fired central heating, window replacement and roof insulation.

In more recent years, the social housing schemes at Queens Street, Bridgefoot St, Ballybough and Bunratty Road have undergone major energy-efficient refurbishment (or are currently under construction)



Fig 14: Bridgefoot Street refurbishment works

This has brought the energy performance up to an energy standard equivalent to current Building Regulations for new-build. The energy aspects of the refurbishment works have been made possible by financial support from the National Development Plan through the 'House of Tomorrow' programme managed by Sustainable Energy Ireland (SEAI) and co-ordinated by Codema.

Value was added to this work through the 'ROSH (Retrofitting of Social Housing)' project, also co-ordinated by Codema, and supported under the European Commission 'Intelligent Energy Europe' programme, through exchanges of information and know-how with other cities across Europe.

DCC's Housing Energy Action Plan 2009-2020

The Housing Department is currently developing an Action Plan for further upgrading the energy performance of existing dwellings and assessing their Building Energy Rating as they turn over tenancies, at the rate of approximately 1,200 units per year.

The prime objective is to prepare an Energy Action Plan for Dublin City Council's housing stock that provides a framework for the implementation of the City Council's Climate Change Strategy over the period 2009 to 2020, with the target of reducing the CO₂ emissions from its own housing stock by 33%.

The action plan will apply to all of DCC social housing stock, providing a harmonized strategy for dealing with all energy related issues for both new and existing social housing. A benchmark of current energy consumption will be calculated allowing DCC to fully account for all energy and CO₂-related benefits resulting from future investment in the housing stock

The Action Plan will in general follow the format of the Action Plan on Energy for Dublin and will contain the following principle elements:

- An analysis of the characteristics of the existing social housing stock
- A baseline energy consumption of the current DCC housing stock based on the DEAP methodology
- An analysis of future scenarios and the overall effect on energy consumption and CO₂ emissions
- An analysis of the principle alternative energy usage scenarios applying to the housing stock
- A financial analysis of the different scenarios
- Proposed timeline for implementation of proposed measures to meet the Climate Change Strategy
- Identification of resources required to implement the action plan

Codema is responsible for the development and delivery of the DCC Housing Energy Use Action Plan 2009 - 2020 in association with Dublin City Council Housing and Residential Services Department.

District Heating and cooling (2008-)

It is proposed to create an entirely new district heating scheme for Dublin, including the setting up of a new 'Dublin District Heating Company'.

Dublin City has both the size and concentration of large buildings to host a large district heating system, although no significant district or heating currently exists in Ireland.

Despite the mild Irish climate, heating is necessary for about 9 months of the year and domestic hot water is needed year round. In addition, there is a demand for cooling of hotels, offices and shopping centres during the summer season

This view is supported by a recent study by IVL – the Swedish Environmental Research Institute, which examines the impact of introducing district heating into areas of Dublin where the heating demand is over 60 GWh/km². In these areas the primary energy use and CO₂ emissions would be reduced by 80% and 82%, respectively.

The Swedish report took as its point of departure the four established socio-ecological principles for a sustainable society:

- (i) Substances extracted from the lithosphere must not systematically accumulate in the ecosphere
- (ii) Society-produced substances must not systematically accumulate in the ecosphere
- (iii) The physical conditions for production and diversity within the ecosphere must not systematically be deteriorated
- (iv) The use of resources must be effective and just with respect to meeting human needs

These principles were adapted and used as a foundation for the activities of The Natural Step, as already referred to in the Introduction and used by Dublin City Council as a sustainability framework.

This will contribute to Dublin's targets for sustainable energy and climate by:

- Reducing Dublin City's carbon footprint by 10% to 15%
- Opening up the potential to use renewable energy technologies extensively for heating Dublin's existing and future buildings
- Utilising waste heat from electricity production, resulting in energy efficiency gains of 20% to 25%

Feasibility Study

Dublin City Council appointed RPS and COWI (a Danish engineering consultancy company) to undertake a feasibility study on the potential for the implementation of a Citywide District Heating Network.

The basic idea behind district heating is to use low-grade heat sources that would otherwise be wasted. The proposed district heating network for Dublin will circulate hot water in an underground, pre-insulated pipe system.

The feasibility study assessed three alternative scenarios of differing scales and at various locations throughout Dublin City, from the Poolbeg peninsula to the new Heuston South Quarter.

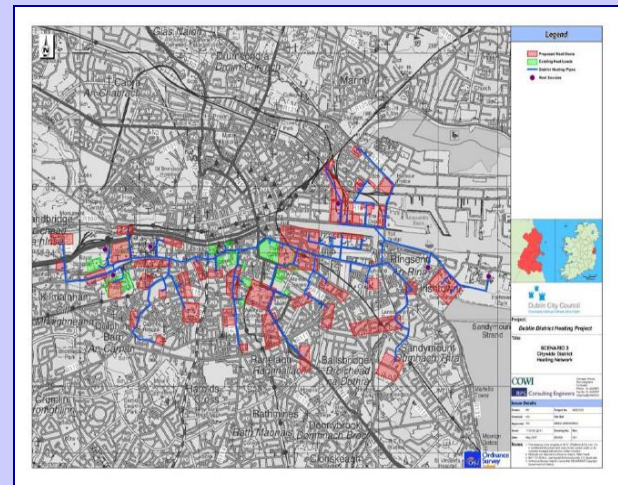


Fig. 15: Feasibility Study: Poolbeg to Heuston (Source: RPS)

Business Plan

A Strategic Business Plan for the new Dublin District Heating Company (DDH Co) is currently being prepared.

The Company will be established as an independent company, initially 100% owned by Dublin City Council

Its mission is:

“To procure sources of waste heat produced within Dublin and re-use that heat to provide sustainable commercial district heating services to Dublin on a profitable basis”

It is expected that the DDH Co will operate as a self-sustaining commercial entity as quickly as possible, including responsibility for the district heating system assets and related financial obligations.

Transport

Transport in Dublin has experienced an immense and unforeseen growth in the 15 years from 1990 to 2006. In this period the number of road vehicles has increased by 104% with a corresponding 167% increase in CO₂ emissions.

Necessary improvements of the existing infrastructure are being delivered by 'Transport 21' (T21), the national capital investment framework through which the transport system in Ireland is to be developed, over the period 2006 to 2015, although certain parts of the programme may now be delayed due to the economic recession.

T21 allocated €14bn to the Greater Dublin Area in order to develop both individual and public transport: including bus, rail, metro and LUAS. These projects will be managed by a new Dublin Transport Authority.

Dublin City Council plays a central role in delivering certain elements such the Port Tunnel, the Quality Bus Corridors and the Greater Dublin Strategic Cycle Network, and through the planning process.

As the SEAP is inherently sustainable, key recommendations for the transport sector should focus on the upgrading of existing infrastructure, such as footpaths, cycleways, bus routes etc. New infrastructure of this type should be located in areas of high density urban populations and seek to utilise existing infrastructural corridors.

Dublin City Council appointed a Mobility Manager and launched its 'Workplace Travel Plan' as a 'soft measure' (February 2009) to promote more sustainable commuting within the organization. The plan was developed by Codema in collaboration with Vipre Ltd., transport demand management specialists, as part of the EU 'ASTUTE' project.

The Workplace Travel Plan is being piloted at the Civic Offices but many of its actions can be applied to all Council sites and will be applicable in the wider community.

More generally, the business community in Dublin has an opportunity to recoup financial and corporate benefits, while also helping to reduce the City's carbon footprint, through developing company Workplace Travel Plans for offices which employ at least 100 staff members.

'Green eMotion' - FP7 project (2011-2015)

Electric Vehicles & Charging Infrastructure

Green eMotion aims at the creation of a unique and user-friendly framework for green electromobility in the EU. Dublin is a partner city in this European project (FP7) which will commence in March 2011.

Codema will co-ordinate the facilitation and communication between the local authorities and the Electricity Supply Board (ESB) on this demonstration project, with the aim of achieving the following objectives:

- Reduction in CO₂ levels for the Dublin City region through the implementation of an e-vehicle system for the city
- Creation of sustainable solutions for the city's transport network, e-vehicles, more efficient public transport, improved cycle ways, etc.
- Exchange of best practice with our European partners to establish the implementation of an e-vehicles network in the Dublin city region



Fig 16: Electric hybrid Dublin Bus on the 16 bus route

As part of this project, Codema aims to carry out the following activities:

- **Facilitation** of participation and communication between the four Dublin Councils and the ESB.
- **Integration** of electric vehicles within an overall sustainable energy plan for a green and energy smart city – possible 'smart energy zones'.
- **Communication** and promotion of the e-vehicles system among key stakeholders and the general public.

Renewable Energy

Dublin has significant capacity to produce renewable heat and electrical energy by means of utilising some existing and planned large-scale infrastructure plant, such as the Ringsend Waste Water Treatment Works.

There is a potential to develop deep geothermal energy resources, as is being considered for the new Dublin Institute of Technology, Grangegorman.

In addition, there is scope to develop a large number of small-scale CHP, solar, hydro and urban wind projects which, when combined, have considerable gross renewable energy potential.

The development of such projects, to be truly sustainable, should have due regard to the existing habitat and should also be located in areas of existing urban development.

Small-scale Renewable Energy projects



Fig. 17: Wind turbines (5 x 50 kW) at Fr Collins Pk.
(Photo by Will Coroner)



Fig. 18: Water turbine (90 kW) at Roundwood Waterworks provides 100% of the power requirement for the works

Ringsend Waste Water Treatment Works

The sewerage works at Ringsend treats a waste water load of 1.9 million persons-equivalent from a catchment area that includes all of Dublin City and part of Fingal, Meath, South Dublin and Dun Laoghaire-Rathdown Counties.

Normally, in the biological process the sewerage treatment produces large quantities of methane gas, which is a harmful greenhouse gas, over 20 times more potent than CO₂.

In Ringsend Works the methane gas is captured and reused in a CHP engine to generate 40% of the electrical load of the works and a major proportion of the steam heating requirement. In total, the methane gas produces in the region of 90 GWh/yr of renewable energy – equivalent to around one fifth of the Council's total energy consumption.



Fig. 19: Ringsend Waste Water Treatment Works

The renewable energy CHP at Ringsend:

- Generates up to 4 MW electricity from waste methane
- Caters for 40% of energy requirements for plant
- Saves in the region of €2.5 m per year in energy charges
- Reduces fossil fuel by 7,500 tonnes oil equivalent per year
- Reduces CO₂ emissions by 13,000 tonnes carbon dioxide per year
- Reduces methane emissions by 5,780 tonnes methane per year, equal to 120,000 tonnes CO_{2equivalent} per year

Conclusions

1. The challenge of climate change

Dublin faces real challenges in meeting its climate change obligations and it is now clear that a business-as-usual scenario is not an acceptable option, even in the short term.

The detailed analysis shows that, despite the difficulty of the challenge, Dublin can meet its greenhouse gas emissions targets through a combination of short-term energy efficiency actions along with a more long-term investment in sustainable infrastructure.

2. First step is energy efficiency

Simple energy efficiency measures, such as insulation of buildings, switching off lights and appliances when not in use, and limiting unnecessary car use, can keep Dublin's emissions trajectory on track for the next five years, i.e. until 2014. These simple measures will actually save a lot of money - savings that can be re-invested in new energy-efficient technology: for lighting, domestic appliances and office equipment.

The combination of behavioural changes and new technology can reverse the present upward trend in energy consumption, and associated CO₂ emissions, and contribute significantly towards meeting the Irish and EU target of a 20% reduction by the year 2020.

3. Barriers to implementation

Even though energy efficiency is one of the major potential contributors for dealing with energy-related challenges, particularly in buildings, there are still non-technological barriers that limit wide-scale implementation, including the following:

- a. Cost of extra materials & longer time on-site
- b. Risk of legal proceedings against architects
- c. Developers are not end-users (i.e. capital vs running costs)
- d. Lack of existing examples

4. Investment in infrastructure

It is also clear from the technical analysis that energy efficiency alone is not enough to keep Dublin's emissions trajectory on track through to 2020 and beyond.

A significant investment is required in:

- Dublin District Heating project
- Transport 21 - public transport
- Renewable energy

And, critically, the investment must start without delay.

New and innovative financial mechanisms may be required for the long-term sustainable infrastructure investment that is absolutely essential in Dublin's adjustment to a low-carbon economy.

5. All sectors are necessary

But, Dublin City Council alone cannot meet the challenges. The public service and private sectors will need to work together along with the education and research institutions so that the whole is much greater than the sum of the individual contributions.

Finally, while business and technology are very important, the challenges of climate change cannot be met without the active participation of Dublin's local communities.

Appendix 1: EU SEAP Template



Introduction

This Sustainable Energy Action Plan (SEAP) template has been developed by the EU Covenant of Mayors Office in Brussels and the Joint research Council at Ispra.

It aims to summarize the key information contained in individual city's SEAPs, in a standardized format.

Contents

The format of the template is an EXCEL spreadsheet, designed to be uploaded by all Covenant of Mayors signatories to the website www.eumayors.eu.

This SEAP template is in three parts:

1. Overall Strategy
2. Baseline Emissions Inventory
3. Sustainable Energy Action Plan

For convenience, in the *'Dublin City Sustainable Energy Action Plan – version 2'* the content of the EXCEL spreadsheet is reproduced as this Appendix.

Commitment

In signing up to the Covenant of Mayors, Dublin City Council is committed to submitting this Sustainable Energy Action Plan including this baseline emissions inventory, which outlines how the sustainable energy objectives will be reached, within one year of the Lord Mayor's signature.

An implementation report will also be submitted to the Covenant of Mayors office at least every second year following the submission of the Action Plan for evaluation, monitoring and verification purposes.

Overall Strategy

1. Overall CO₂ Emissions Target

- 20% by 2020
- Per capita reduction

2. Long-term vision of your local authority (please include priority areas of action, main trends and challenges)

Dublin's long-term vision is to become an energy-smart city by 2030.

Over the next twenty years, the introduction of carbon neutral and low-energy buildings, improvements in information technology and the development of a low-carbon transport system will help Dublin reduce its carbon emissions by 50 per cent. For example, retrofitting of the existing housing market will bring the building energy rating of a typical Dublin home from an E to a C rating, and electricity use will become much more intelligent through the introduction of smart meters.

Dublin's transport sector will also change dramatically as electric vehicles become more common on our city's streets and improved cycle-ways will make cycling more accessible. Dublin City Council will also continue to increase its use of renewable energy sources for its housing and public amenities.

Overall, we are committed to the principles of best energy policy for the creation of Dublin as an energy-smart city.

3. Organizational and financial aspects

Coordination and organizational structures created/assigned

Dublin City Council Steering Committee:

- Seamus Lyons, Assistant City Manager for Environment & Engineering
- Michael Phillips, Director of Traffic & City Engineer
- Kathy Quinn, Head of Finance
- Dick Gleeson, Dublin City Planner
- Ali Grehan, City Architect
- Michael O'Neill, Executive Manager, Housing & Residential Services
- Aidan Maher, Senior Executive Officer, Corporate Services
- Margaret Coyle, Senior Executive Planner
- Gerry Wardell, Director Codema

Staff capacity allocated

Two full-time-equivalent staff members of Codema are involved in drafting the Action Plan, along with approximately 100 person-hours per year senior staff of Dublin City Council.

Involvement of stakeholders and citizens

At the start of the process in 2007/08, pre-draft consultations with 50 organisations, including Dublin City Council Departments, Government Departments & agencies, engineering consultants, Education and Research Institutions, Residents' Associations, and the Youth organisation 'Comhairle no n'Og'.

A formal public consultation of the draft Sustainable Energy Action Plan was carried out in March/April 2010.

Overall estimated budget

€200,000 per year for organizational aspects of SEAP.

Circa €989 million for implementation of all the 'Scenario 1' measures of the Action Plan, including district heating but excluding 'Transport 21' infrastructure investments.

Foreseen financing sources for the investments within your action plan

Irish national exchequer under the National Development Plan; Dublin City Council; European Investment Bank, including ELANA programme of Technical Assistance; Public Private Partnerships; Sustainable Energy Ireland grants; European Commission Programmes: Intelligent Energy Europe (soft measures), Leonardo Programme, FP7 (Research, Development & Demonstration); European Regional Development Fund – INTERREG

Planned measures for monitoring and follow up

Codema will monitor the measures and actions and update the Emissions Inventory on an annual basis. These results will be reported to the Dublin City Council Steering Committee, and the Covenant of Mayors Office. An implementation report will also be submitted to the Covenant of Mayors office at least every second year following the submission of the Action Plan for evaluation, monitoring and verification purposes.

Baseline Emission Inventory

1 Inventory Year

- 2006

For Covenant signatories who calculate their CO₂ emissions per capita, please precise here the number of inhabitants during the inventory year:

- 506,211

2 Emission factors

- Standard emissions factors in line with IPCC principles

Emission reporting unit:

- CO₂ emissions

3 Key results of the Baseline Emissions Inventory

A. Final Energy Consumption

Category	FINAL ENERGY CONSUMPTION [MWh]															
	Electricity	Heat/cold	Fossil Fuel							Renewable energies				Total		
			Nat gas	Liquid gas	Heat Oil	Diesel	Gasoline	Lignite	Coal	Other fossil	Plant oil	Bio-fuel	Other bio-mass	Solar thermal	Geothermal	
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:																
Municipal buildings, equipment/facilities	44076		52651													96727
Tertiary (non municipal) buildings, equipment/facilities	1256881		679035		579392											2515308
Residential buildings	929643	54920	3489702		1395817							12000	100	50		5882232
Municipal public lighting	21171															21171
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	867539	174552	819003		917935											2779029
Subtotal buildings, equipments/facilities and industries	3119310	229472	5040391	0	2893144	0	0	0	0	0	0	12000	100	50		2875756
TRANSPORT:																
Municipal fleet						38407	447									38854
Public transport	20459					314391	81742									416592
Private and commercial transport						1626292	2487954					16551				4130797
Subtotal transport	20459					1979090	2570143					16551				4586243
Total	3139769	229472	5040391	0	2893144	1979090	2570143	0	0	0	16551	12000	100	50		7461999

Municipal purchases of certified green electricity (if any) [MWh]:	
CO ₂ emission factor for certified green electricity purchases (for LCA approach):	

B. CO₂ or CO₂equivalent emissions

Category	CO ₂ emissions [t] or CO ₂ equivalent emissions [t]															
	Electricity	Heat/cold	Fossil Fuel							Renewable energies					Total	
			Nat gas	Liquid gas	Heat Oil	Diesel	Gasoline	Lignite	Coal	Other fossil	Plant oil	Bio-fuel	Other bio-mass	Solar thermal	Geothermal	
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:																
Municipal buildings, equipment/facilities	29178		10636												39814	
Tertiary (non municipal) buildings, equipment/facilities	832055		137165		161650										1130871	
Residential buildings	615424	14031	704920		389433										1723807	
Municipal public lighting	14015														14015	
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	574311	32241	165439		256104										1028094	
Subtotal buildings, equipments/facilities and industries	2064983	46272	1018159	0	807187	0	0	0	0	0	0	0	0	0	3936601	
TRANSPORT:																
Municipal fleet						10255	111								10366	
Public transport	13544					83942	20354								117840	
Private and commercial transport						434220	619501								1053721	
Subtotal transport	13544					528417	639966								1181926	
OTHER:																
Waste management															127963	
Waste water management															4000	
<i>Please specify here your other emissions</i>																
Total	2078527	46272	1018159	0	807187	528417	639966	0	0	0	0	0	0	0	50	5250491
Corresponding CO ₂ emission factors in [t/MWh]	0.622	0.202	0.202		0.279	0.267	0.249									
CO ₂ emission factor for electricity not produced locally [t/MWh]	0.622															

C. Local electricity production and corresponding CO₂ emissions

Locally generated electricity (excluding ETS plants, and all plants/units >20MW)	Locally generated Electricity [MWh]	Energy carrier input [MWh]										CO ₂ / CO _{2,eq} Emissions [t]	Corresponding CO ₂ Emission factors for Electricity production In [t / M W h]	
		Fossil fuels					Steam	Waste	Plant oil	Other biomass	Other renewable			Other
		Natural gas	Liquid gas	Heating Oil	Lignite	Coal								
Wind power	250												0.22	
Hydroelectric power	1648													
Photovoltaics														
Combined Heat and Power	149790	160989							238712			32520		
Other <i>Please specify</i> _____														
Total	150688	160989							238712			32520		

 D. Local heat/cold production (district heating/cooling, CHPs...) and corresponding CO₂ emissions

Locally generated heat/cold	Locally generated Heat/cold [MWh]	Energy carrier input [MWh]										CO ₂ / CO _{2,eq} Emissions [t]	Corresponding CO ₂ Emission factors for Electricity production In [t / M W h]
		Fossil fuels					Steam Waste	Plant oil	Other biomass	Other renewable	Other		
		Natural gas	Liquid gas	Heating Oil	Lignite	Coal							
Combined Heat and Power	218970	238712							50971			48220	0.22
District Heating plant(s)	54920	53420		11810								12819	0.23
Other <i>Please specify</i> _____													
Total	273890	292132	0	11810	0	0		0	0	0	0	61039	

Sustainable Energy Action Plan

1 Title of your Sustainable Energy Action Plan:

- Dublin Sustainable Energy Action Plan 2010 - 2010

Date of formal approval

- 6th December 2010

Authority approving the plan

- Dublin City Council

2 Timeframe

From

- 2010

To

- 2020

3 Key elements of your Sustainable Energy Action Plan

Summary

Sectors	Ref. Code	CO ₂ Reduction Target* (t CO ₂ in 2020)
Buildings Equipment/Facilities and Industries	B	616000
Transport	T	369000
Local Energy Production	EP	1000
Local District Heating/Cooling, CHP's	DH	47000
Land Use Planning	P	156000
Public Procurement of Products and Services	PP	0
Working with Citizens and Stakeholders	C	0
Other Sectors	OS	0
Total		1189000

*Note CO₂ Reduction target does not include reductions in national electricity emissions factor

Buildings Equipment/Facilities and Industries (B)	Key Actions (B)	Responsible Person/Department	Implementation Start/End Time	Status: Complete Ongoing Planned
Municipal Buildings, equipment/facilities	B1.1 - Switch Off Campaign	Suzanne Morgan, Codema	2009-2010	C
	B1.2 - Display Energy Certificates	Cormac O'Brien, Codema	2009-2020	O
	B1.3 - Kilbarrack Fire Station - Sustainability Pilot	Fire Dept., DCC	2009-2012	C
	B1.4 - Civic Offices energy upgrade	Corporate Services, DCC	2009-2012	O
	B1.5 - Centralised Energy Database	Declan McCormac, Codema	2009-2010	C
	B1.6 - Mansion House Refurbishment	City Architects, DCC	2010-2012	P
	B1.7 – Fairview Park Sports facility	City Architects	2011-2012	O
Tertiary (non municipal) Buildings, Equipment/Facilities	B2.1 – Strategy for renewable heat demand	Codema & DCC	2016-2020	P
	B2.2 – Strategy for renewables-low energy housing	Codema & DCC	2016-2020	P
	B2.3 – Facilitation of new zero carbon buildings	Codema & DCC	2016-2020	P
Residential Buildings	B3.1 – Energy Smart Community project	Joe Hayden, Codema	2009-2012	O
	B3.2 – Social Housing Action Plan	Joe Hayden, Codema/ Housing Dept DCC	2009-2010	O
	B3.3 – Energy retrofit of void social housing	Housing Dept, DCC	2009-2020	O
	B3.4 – Minimum BER spec for New Lease housing	Housing Dept, DCC	2009-2010	O
	B3.5 – House of Tomorrow, Bunnratty Rd	Edel Giltenane, Codema/ Housing Dept, DCC	2008-2009	C
	B3.6 – House of Tomorrow, York Street	Edel Giltenane, Codema/ Housing Dept, DCC	2007-2009	C
	B3.7 – Ballymun Regeneration, Phase 4	BRL/DCC	2009-2012	O
	B3.8 – Energy upgrade, Glover Court	City Architects, DCC	2009-2012	P
	B3.9 – Passive House scheme, Pilot project	City Architects, DCC	2010-2014	P
Municipal Public Lighting	B4.1 – Public lighting energy efficiency	Engineering Dept, DCC	2011-2014	P
Industries	B5.1 – Green Innovation project	Joe Hayden, Codema/INTERREG IVB NWE	2010-2013	O
Other				

Transport	Key Actions (T)	Responsible Person/Department	Implementation Start/End Time	Status: Complete Ongoing Planned
Municipal Fleet	T1.1 – Eco Driving Campaign	Suzanne Morgan, Codema	2009-2010	O
Public Transport	T2.1 – Dublin Bike Rental T2.2 – Workplace Travel Plans T2.3 – Cycle way upgrades T2.4 – Cycle Officer T2.5 – Metro North to Dublin Airport & Swords T2.6 – Metro West orbital T2.7 – LUAS Line A1 – City West Extension T2.8 – LUAS Line B1 – Sandyford to Cherrywood T2.9 – LUAS Line B2 – Cherrywood to Bray T2.10 – LUAS Line BX-Line 2 to Liffey Junction T2.11 – LUAS Line C1 – Docklands Extension T2.12 – LUAS Line F to Lucan T2.13 – DART underground interconnector	JCDecaux/DCC Emma Collins, Codema/DCC OPW/DCC DCC Transport 21/RPA Transport 21/RPA Transport 21/RPA Transport 21/RPA Transport 21/RPA Transport 21/RPA Transport 21/RPA Transport 21/RPA Transport 21/RPA	2009-2020 2009-2020 2010-2020 2008-2020 2010-2014 - 2009-2011 2008-2010 - - 2008-2009 - 2011-2015	O O P O P P O C P P C P P
Private and Commercial Transport	T3.1 – Green eMotion: EV charging infrastructure	Suzanne Morgan, Codema/ Dublin Local Authorities/ESB/FP7	2010-2020	O
Other				

Local Electricity Production	Key Actions (EP)	Responsible Person/Department	Implementation Start/End Time	Status: Complete Ongoing Planned
Hydroelectric	EP1.1 – Roundwood Waterworks 90kW turbine	Engineering Dept, DCC	2007-2009	C
Windfarms	EP2.1 – Fr Collins Park, 5X50kW wind turbines	Parks Dept, DCC	2007-2009	C
PVs	EP3.1 – Emerald project, Ballymun	Solearth/CLUID	2009-2011	O
CHPs				
Other				

Local District Heating/ Cooling, CHPs	Key Actions (DH)	Responsible Person/Department	Implementation Start/End Time	Status: Complete Ongoing Planned
CHPs				
District Heating Plant	DH2.1 – Dublin District Heating scheme	Engineering Dept, DCC	2011-2013	P
Other	DH3.1 –Poolbeg Waste Water Treatment extension	Engineering Dept, DCC	2011-2014	P

Land Use Planning	Key Actions (P)	Responsible Person/Department	Implementation Start/End Time	Status: Complete Ongoing Planned
Strategic Urban Planning	P1.1 – Dublin City Development Plan 2011-2016	Planning Dept, DCC	2011-2016	P
Transport/Mobility Policy				
Standards for Refurbishment & New Development	P2.1 – Variation 22, Dublin City Development Plan 2006-2010	Codema/Planning Dept, DCC	2007-2010	C
Other				

Public Procurement of Products and Services	Key Actions (PP)	Responsible Person/Department	Implementation Start/End Time	Status: Complete Ongoing Planned
Energy Efficiency Requirements/Standards				
Renewable Energy Requirements/Standards				
Other				

Working With Citizens and Stakeholders	Key Actions (C)	Responsible Person/Department	Implementation Start/End Time	Status: Complete Ongoing Planned
Advisory Services				
Financial Supports and Grants				
Awareness Raising and Local Networking	C3.1 – Energy Days	Suzanne Morgan, Codema	2010-2014	P
Training and Education	C4.1 – Sustainable Office project	Declan McCormac, Codema	2008-2010	O
Other				

Other Sectors	Key Actions (OS)	Responsible Person/Department	Implementation Start/End Time	Status: Complete Ongoing Planned
Other	OS1.1 –Smarter Cities	Gerry Wardell, Codema/Dublin Local Authorities/IBM	2010-2012	O

Appendix II: Relationship with Other Plans

Introduction

The SEAP sits within a hierarchy of European, national, regional and local planning policies. A number of plans, policies, programmes and Directives at European, national, regional and local level have been identified and taken on board in the preparation of the SEAP. The list below sets out the main plans, policies, programmes and Directives identified and gives a brief summary of their main objectives

EU Level

- **EU SEA Directive (2001/42/EC):** Under the SEA Directive the SEAP requires an SEA. The SEAP must take into account protection of the environment and integration of the plan into the sustainable planning of the country as a whole.
- **Kyoto Protocol:** Objectives seek to alleviate the impacts of climate change and reduce global emissions of GHGs. The formulation of the SEAP gives regard to the objectives and targets of Kyoto and aim to reduce green house gas (GHG) emissions from the management of residential, transport and commercial development. Harnessing energy from natural resources is considered to reduce overall GHG emissions.
- **EU Directive (96/62/EC) (Air Quality Directive):** Objective is to improve air quality by controlling the level of certain pollutants and monitoring their concentrations.
- **EU Floods Directive (2007/60/EC):** Aim is to reduce and manage the risk that floods pose to human health, the environment, cultural heritage and economic activity.
- **EU Habitats Directive (92/43/EEC):** Protects over 1000 animals and plant species and over 200 'habitat types' which are of European importance.
- **Covenant of Mayors:** Dublin ratified the covenant on the 25th of March 2009. 1200 European cities have signed up to go beyond the EU 2020 targets for 20% reduction in CO₂ emissions.
- **Energy Services Directive (2006/32/EC)** on energy end-use efficiency and energy services
- **Renewable Energy Directive (2009/28/EC)** on the '*promotion of the use of energy from renewable sources*' (2009/28/EC)
- **IEE Minus 3% project:** DCC in partnership with Codema are participating in the project with 6 other European cities and their associated energy advisors to formulate actions to increase energy efficiency towards 3% per year over three years.
- **Energy Performance of Buildings Directive (2002/91/EC):** The Directive requires that all buildings built or rented require a certificate of their energy performance. Public buildings also require a display energy certificate (DEC) of their annual energy performance.

National Level

- **National Climate Change Strategy 2007-2012:** The strategy sets out measures by which Ireland will achieve its commitments under the Kyoto protocol and associated EU commitments.
- **National Spatial Strategy:** 20-year national planning framework to achieve more balanced social, economic and physical development across Ireland based on Gateways and Hubs.
- **National Development Plan 2007-2013:** €184 mil infrastructural investment plan to build a prosperous country for Ireland's population.
- **Transport 21:** €34 billion transport capital investment framework under the NDP to address past investment backlogs and continuing growth in transport demand.
- **National Biodiversity Plan, 2002, subsequent review 2005 and draft 2008 – 2012 plan submitted to government summer 2009:** Objective to promote the conservation and sustainable use of biodiversity.

- **National Energy Efficiency Action Plan 2009-2020 (NEEAP):** Sets out the Government's actions to achieve 20% energy efficiency savings from increased efficiencies.
- **National Renewable Energy Action Plan (NREAP)** sets out the Government's strategic approach and concrete measures to deliver on Ireland's 16% target under Directive 2009/28/EC.
- **Sustainable Residential Development in Urban Areas – Guidelines for Planning Authorities 2008:** Objective to produce high quality sustainable development which includes the integration of schools, community facilities, employment, transport and amenities in a timely and cost effective manner.
- **Grid 25:** A strategy for the development of Ireland's electrical grid for a sustainable and competitive future.

Regional Level

- **Review of the Regional Planning Guidelines 2004 – 2016 and preparation of new Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022 (draft):** Aims to direct the future growth of the GDA over the medium to long term involving sustainable planning and through the protection of environmentally sensitive or important locations.
- **DTO Strategy 2000 – 2016 A Platform for Change:** Integrated, multi-modal transportation strategy for the GDA
- **2030 Vision, DTO (yet to be published):** To identify areas of accessibility within the Dublin Region and the most appropriate locations for intensification.
- **River Dodder Catchment Flood Risk Assessment and Management Study:** Examination of the Dodder catchment area.
- **Fingal and East Meath Flood Risk Assessment and Management Study (FEMFRAM):** Flood risk management plan.

Dublin City Level

- **Dublin City Council Biodiversity Action Plan 2008:** Aims to achieve the objectives of the Development Plan relating to quality of life, green spaces, amenity provision, planning development and protection of the natural heritage in the city as well as working towards the world target the "achievement by 2010 of a significant reduction in the current loss of biological biodiversity".
- **Green City Guidelines – Advice for the Protection and Enhancement of Biodiversity in Medium to High-Density Urban Developments 2008:** Provides practical guidance to planners and developers on how to integrate biodiversity into new developments, specifically medium to high density housing developments in urban areas.
- **Climate Change Strategy for Dublin City 2008 – 2012:** Focuses on the continuation of the implementation of a range of measures across key areas involving a cross-cutting approach and includes targets in energy, planning, transport, waste management.
- **Dublin City Draft Development Plan 2011 – 2017:** The Draft Development plan sets out a planning strategy and framework to steer the future development of the city, including a spatial framework that consolidates the city by land use intensification and integration of transport infrastructures. The draft SEAP was part of this process.



