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Identifying pressures • Informing policy • Developing solutions

Roadmap for a National Resource Efficiency Plan for Ireland

Comhshaol, Pobal agus Rialtas Áitiúil
Environment, Community and Local Government

www.epa.ie

Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable.

The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Community and Local Government.

OUR RESPONSIBILITIES

LICENSING

We license the following to ensure that their emissions do not endanger human health or harm the environment:

- waste facilities (e.g., landfills, incinerators, waste transfer stations);
- large scale industrial activities (e.g., pharmaceutical manufacturing, cement manufacturing, power plants);
- intensive agriculture;
- the contained use and controlled release of Genetically Modified Organisms (GMOs);
- large petrol storage facilities;
- waste water discharges;
- dumping at sea.

NATIONAL ENVIRONMENTAL ENFORCEMENT

- Conducting over 1200 audits and inspections of EPA licensed facilities every year.
- Overseeing local authorities' environmental protection responsibilities in the areas of - air, noise, waste, waste-water and water quality.
- Working with local authorities and the Gardaí to stamp out illegal waste activity by co-ordinating a national enforcement network, targeting offenders, conducting investigations and overseeing remediation.
- Prosecuting those who flout environmental law and damage the environment as a result of their actions.

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- Monitoring air quality and the quality of rivers, lakes, tidal waters and ground waters; measuring water levels and river flows.
- Independent reporting to inform decision making by national and local government.

REGULATING IRELAND'S GREENHOUSE GAS EMISSIONS

- Quantifying Ireland's emissions of greenhouse gases in the context of our Kyoto commitments
- Implementing the Emissions Trading Directive, involving over 100 companies who are major generators of carbon dioxide in Ireland.

ENVIRONMENTAL RESEARCH AND DEVELOPMENT

- Co-ordinating research on environmental issues (including air and water quality, climate change, biodiversity, environmental technologies).

STRATEGIC ENVIRONMENTAL ASSESSMENT

- Assessing the impact of plans and programmes on the Irish environment (such as waste management and development plans).

ENVIRONMENTAL PLANNING, EDUCATION AND GUIDANCE

- Providing guidance to the public and to industry on various environmental topics (including licence applications, waste prevention and environmental regulations).
- Generating greater environmental awareness (through environmental television programmes and primary and secondary schools' resource packs).

PROACTIVE WASTE MANAGEMENT

- Promoting waste prevention and minimisation projects through the co-ordination of the National Waste Prevention Programme, including input into the implementation of Producer Responsibility Initiatives.
- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

MANAGEMENT AND STRUCTURE OF THE EPA

The organisation is managed by a full time Board, consisting of a Director General and four Directors.

The work of the EPA is carried out across four offices:

- Office of Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

EPA Research

Roadmap for a National Resource Efficiency Plan for Ireland

2011-WRM-DS-03

EPA Research Report

Prepared for the Environmental Protection Agency
by
Clean Technology Centre, Cork Institute of Technology

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Disclaimer

The EPA Research addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection.These reports are intended as contributions to the necessary debate on the protection of the environment.

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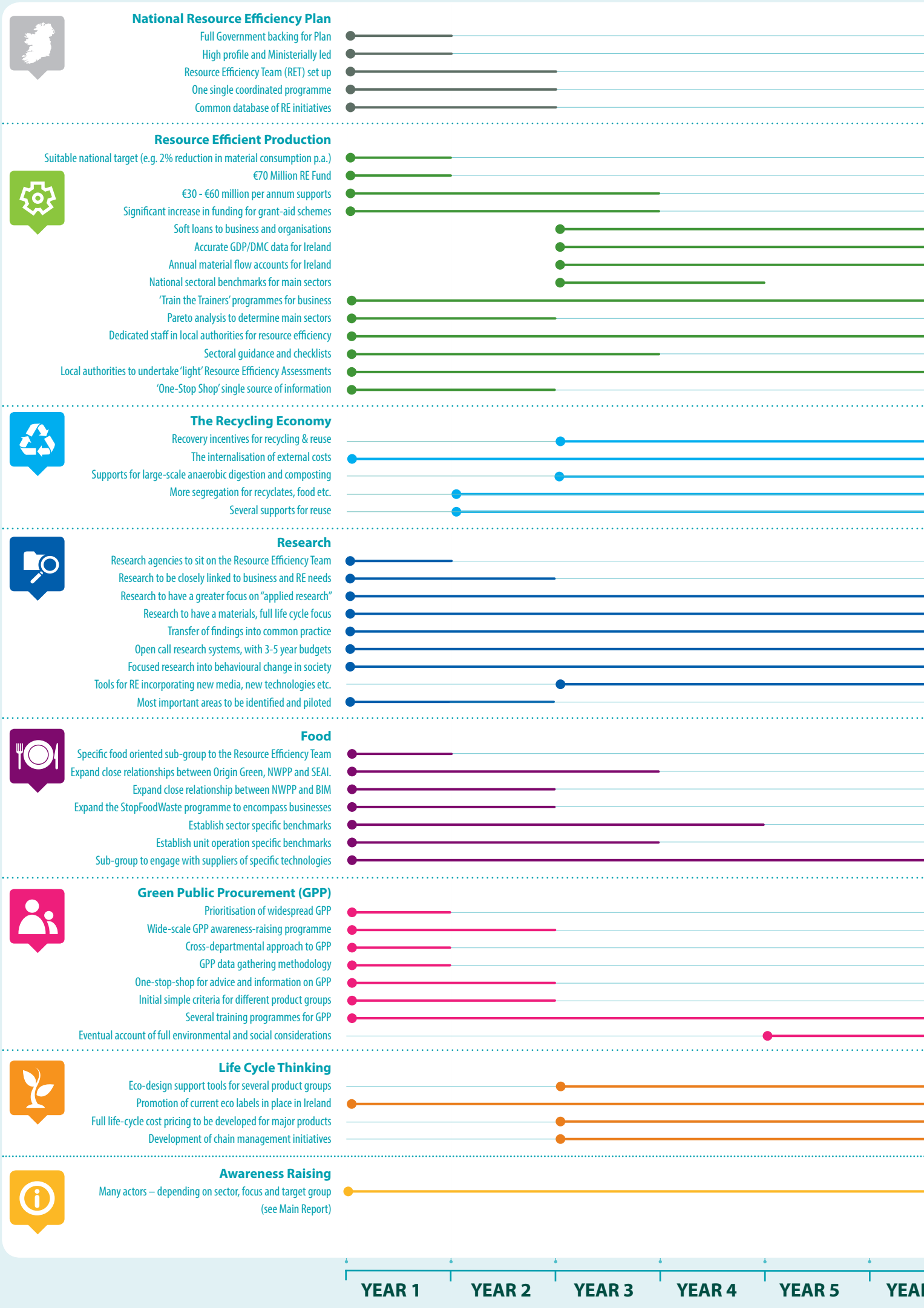
National Resource Efficiency Plan
Full Government backing for Plan
High profile and Ministerially led
Resource Efficiency Team (RET) set up
One single coordinated programme
Common database of RE initiatives
Resource Efficient Production
Suitable national target (e.g. 2% reduction in material consumption p.a.)
€70 Million RE Fund
€30 - €60 million per annum supports
Significant increase in funding for grant-aid schemes
Soft loans to business and organisations
Accurate GDP/DMC data for Ireland
Annual material flow accounts for Ireland
National sectoral benchmarks for main sectors
'Train the Trainers' programmes for business
Pareto analysis to determine main sectors
Dedicated staff in local authorities for resource efficiency
Sectoral guidance and checklists
Local authorities to undertake 'light' Resource Efficiency Assessments
'One-Stop Shop' single source of information
The Recycling Economy
Recovery incentives for recycling & reuse
The internalisation of external costs
Supports for large-scale anaerobic digestion and composting
More segregation for recyclates, food etc.
Several supports for reuse
Research
Research agencies to sit on the Resource Efficiency Team
Research to be closely linked to business and RE needs
Research to have a greater focus on "applied research"
Research to have a materials, full life cycle focus
Transfer of findings into common practice
Open call research systems, with 3-5 year budgets
Focused research into behavioural change in society
Tools for RE incorporating new media, new technologies etc.
Most important areas to be identified and piloted
Food
Specific food oriented sub-group to the Resource Efficiency Team
Expand close relationships between Origin Green, NWPP and SEAI.
Expand close relationship between NWPP and BIM
Expand the StopFoodWaste programme to encompass businesses
Establish sector specific benchmarks
Establish unit operation specific benchmarks
Sub-group to engage with suppliers of specific technologies
Green Public Procurement (GPP)
Prioritisation of widespread GPP
Wide-scale GPP awareness-raising programme
Cross-departmental approach to GPP
GPP data gathering methodology
One-stop-shop for advice and information on GPP
Initial simple criteria for different product groups
Several training programmes for GPP
Eventual account of full environmental and social considerations
Life Cycle Thinking
Eco-design support tools for several product groups
Promotion of current eco labels in place in Ireland
Full life-cycle cost pricing to be developed for major products
Development of chain management initiatives
Awareness Raising
Many actors – depending on sector, focus and target group
(see Main Report)
YEAR 1
YEAR 2
YEAR 3
YEAR 4
YEAR 5
YEA

National Resource Efficiency Plan SUMMARY CHART

Responsibilities	Potential Return	Potential Cost
Full Government	High	Low
Full Government	High	Low
Government	High	Medium
Full Government, national agencies such as the EPA, SEAI, EI et alia.	High	Low
Resource Efficiency Team (RET)	High	Low

Responsibilities	Potential Return	Potential Cost
RET	None	Low
Government	High	High
Government	High	High
RET	High	High
Government in the first instance.	High	High
RET, CSO et al.	None*	Low
CSO, DFin, RET	None	Low
Coordinated by RET	None	Low
Coordinated by RET	Medium	Low
Coordinated by RET	None	Low
EPA, LAPN	Medium	Medium
Coordinated by RET	Medium	Low
EPA, LAPN	Medium	Low
Coordinated by RET , DJEI, DECLG, EPA, SEAI, EI et al	Medium	Medium

Responsibilities	Potential Return	Potential Cost
DFin, DJEI, DECLG, RET	High	Medium
DFin, DJEI, DECLG, RET	Medium	Low
DFin, DJEI, DECLG.DAFM, RET	Medium	Medium
DECLG, RET	Medium	Low
DFin, DJEI, DECLG.DAFM, RET	High	Medium

Responsibilities	Potential Return	Potential Cost
RET, DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	Medium	Low
RET, DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	Medium	Low
RET, DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	Medium	Low
RET, DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	Medium	Low
RET, DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	High	Medium
RET, DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	Medium	Low
RET, DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	Medium	Medium
Coordinated by RET , DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	Medium-High	Medium
Coordinated by RET , DJEI, DECLG.DAFM, EPA, SEAI, Teagasc, SFI et al	High	Medium-High

Responsibilities	Potential Return	Potential Cost
Coordinated by RET , EPA, SEAI, Bord Bia, BIM, IFA, Teagasc, et al	Medium	Low
RET, EPA, SEAI, Bord Bia, al	Medium	Low
RET, EPA, BIM et al	Medium	Low
RET, EPA	Medium	Medium
Coordinated by RET , EPA, SEAI, Bord Bia, BIM, IFA, Teagasc, et al	Medium	Low-Medium
Coordinated by RET , EPA, SEAI, Bord Bia, BIM, IFA, Teagasc, et al	Medium	Low-Medium
Coordinated by RET , EPA, SEAI, Bord Bia, BIM, IFA, Teagasc, et al	Medium	Low-Medium

Responsibilities	Potential Return	Potential Cost
All Government departments and public agencies, RET	High	Medium
Coordinated by RET, Government departments and public agencies, RET	High	Medium
All Government departments, RET	High	Medium
All Government departments, RET	Medium	Low
DECLG, OPW, DJEI, DFin, RET	Medium	Medium
DECLG, OPW, DJEI, DFin, Coordinated by RET	Medium	Low-Medium
DECLG, OPW, DJEI, DFin, Coordinated by RET	Medium	Medium
DECLG, OPW, DJEI, DFin, Coordinated by RET	Medium	Medium

Responsibilities	Potential Return	Potential Cost
Coordinated by RET, DECLG, DJEI, EPA, SEAI et al	Medium	Medium
RET, EPA, SEAI et al	Medium	Medium
RET, DFin, OPW, DECLG, DJEI, EPA, SEAI et al	Medium-High	Low-Medium
RET, DFin, OPW, DECLG, DJEI, EPA, SEAI et al	Medium	High

Responsibilites	Potential Return	Potential Cost
A series of widespread and intensive awareness raising campaigns	Medium	High

R 6 YEAR 7 YEAR 8

Preface

During 2012/2013, a project entitled: *Roadmap for a National Resource Efficiency Plan for Ireland* (2011-WRM-DS-03) was commissioned by the Environmental Protection Agency under the EPA STRIVE Programme 2007–2013.

The Clean Technology Centre at Cork Institute of Technology carried out the research between February 2012 and January 2013.

The purpose of this study was to assess the current situation in Ireland and elsewhere with regard to resource efficiency and to recommend how, by the development of a roadmap, the Irish performance can potentially be improved.

Note: This report should not be read in isolation. It is a very brief, and simplified version of the main research findings, without any references.

To fully understand the research and its findings, and to assess the sources, it is necessary to read the Main Report (which in turn summarises more detailed interim reports that were developed and delivered on several subjects during the research period).

The Main Report is available from the EPA website.

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HEADLINE FINDINGS

Resource efficiency (RE) means 'doing more with less'. In other words, producing more, earning more, and improving the quality of life – while using fewer resources (materials, water, energy), and doing less harm to the environment and ecosystem.

It is vital, now more than ever, that Ireland seeks to improve Resource Efficiency and Resource Productivity, for two very important reasons:

1. Very large savings can be achieved (greater earnings per unit material used), with potential for **economic benefits** and **job creation**.

2. It is consistent with current Government policy and programmes to promote a 'Green Economy'.

At present, Ireland spends approximately **€46 billion** **on raw materials** per annum.

Thus, if Ireland becomes even slightly more resource efficient, significant savings can be made for the country, giving an economic boost and supporting job creation. Relatively small investments could achieve major financial improvements.

Targets

A TARGET OF 2% REDUCTION IN MATERIAL CONSUMPTION SPENDING PER ANNUM, YIELDING SAVINGS OF ABOUT €928 MILLION IN THE FIRST YEAR AND INCREASED ANNUAL SAVINGS THERE-AFTER, IS SUGGESTED IN THIS REPORT

BY 2020 THIS COULD LEAD TO A 25% IMPROVEMENT, YIELDING A TOTAL SAVING OF APPROX **€7 BILLION** OVER THE PERIOD

Already in Ireland, much is being done to support resource efficiency. Progressive legislation is in place and a series of policies and strategies has been developed to improve our performance.

Many activities are taking place in a wide variety of sectors, through the EPA's National Waste Prevention Programme (NWPP), Sustainable Energy Authority of Ireland (SEAI), Enterprise Ireland, Forfás, IDA Ireland, Bord Bia, Bord Iascaigh Mhara (BIM), Teagasc, An Taisce, local authorities and many other organisations.

These are occurring across several business areas and in the public sector. In many cases, for relatively modest investments, they are achieving significant cost savings and economic benefits to society, by reducing unnecessary spending without impacting on outputs.

However, a study of resource efficiency programmes in other countries shows that Ireland can and should be doing more, especially in the following areas:

- Resource Efficient Production
- Recycling Economy
- Research
- Green Public Procurement
- Life Cycling Thinking
- Awareness Raising

To achieve more, a series of actions are recommended in this study to help to create a Roadmap for Resource Efficiency for Ireland, and to meet EU commitments and targets laid out in The European Commission Communication Roadmap to a Resource Efficient Europe (COM (2011) 571).

The main finding of this study is that Ireland currently needs a fully integrated and comprehensive National Resource Efficiency Plan with:

- ✓ **Full Government commitment, from an Taoiseach down**
- ✓ **A Minister's leadership**
- ✓ **A dedicated Resource Efficiency Team**
- ✓ **Sufficient resources to meet the recommended targets**
- ✓ **Full implementation of the detailed activities advocated in this study**

Summary of recommendations to help to create a Roadmap for Resource Efficiency for Ireland.

A National Resource Efficiency Plan

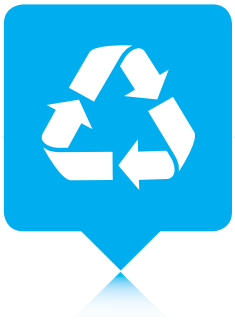
Put in place a coordinated and integrated plan with a dedicated Resource Efficiency Team (RET) on the ground drawing from expertise across the public sector. This should have full Government backing through a cabinet committee chaired by an Taoiseach (as is the case for the Cabinet Committee on Climate Change and The Green Economy) and be actively led by a Minister.

Targets and Funding

With a target of 2% reduction in material consumption spending per annum (without impacting output), and an improvement of 25% between 2013 and 2020, the Plan will require a fund of about €70 million for soft loans (50% from Government), and €30 – 60 million per annum for grant aids, technical assistance and other supports.

Resource Efficient Production

The Resource Efficiency Team (RET) will develop a series of good data sets, create benchmarks, facilitate training programmes, provided guidance, support local authorities and create a ‘one-stop’ information source.



Recycling and Reuse

A set of incentives will be put in place and financial obstacles overcome, with supports for sustainable treatment of food waste, better segregation of all wastes, upcycling supports and the extension of the life cycle of products.

Research

Research agencies will assist the Resource Efficiency Team to ensure that research is closely linked to business needs; research will have more open long term calls and a greater focus on 'applied research' into the most important topics as well as behavioural change, full life cycle of products/ processes and the use of new technologies; findings will be transferred into common practice.

Food

Special focus will be given to resource efficiency in the food sector with the expansion of current relationships and enhancement of existing schemes, the development of benchmarks at sectoral and unit operation levels, and the engagement of technology suppliers.

Green Public Procurement (GPP)

GPP to be greatly prioritised, with wide scale awareness programmes across all Government Departments and public agencies, the development of good data sets and simple product criteria, training programmes and a 'one-stop' information source. Social considerations to be included in due course.

Life Cycle Thinking

Eco design support tools to be developed, and eco labels to be supported; full life-cycle costing for major products, and chain management initiatives to be put in place.

Awareness Raising

A series of focused cost effective, widespread and intensive campaigns to support resource efficiency using agencies and programmes already in place to best effect.

Contents

HEADLINE REPORT

1. What is Resource Efficiency?

At present, there is no widely accepted definition of resource efficiency and The European Commission is currently seeking one. Resource Productivity (RP) is commonly used as a lead indicator and is recommended by the European Commission in its 2011 *Communication Roadmap to a Resource Efficient Europe*.

It is defined as,

$$RE_{IRL} \cong RP = \frac{GDP}{DMC}$$

where GDP = Gross Domestic Product,
and DMC is Domestic Material Consumption

GDP is defined as the monetary value of all the finished goods and services produced within a country's borders in a specific time period, though GDP is usually calculated on an annual basis (usually €/annum)

DMC is defined as the total amount of materials directly used in the economy (used domestic extraction plus imports), minus the materials that are exported (usually tonnes/annum).

NOTE: While using this definition, the European Commission does state that it is inadequate in certain respects and the research team for this study agrees. This is explained in more detail later in this document. Other indicators should also be considered and developed and these are described in the main report upon which this document is based.

The inadequacies relate to several issues including:

- **The use of DMC as a national material consumption indicator,**
- **The problem when correlating DMC (in tonnes) and GDP (in Euro) and**
- **The use of GDP as an economic indicator (GNP, in certain respects, for example, may be a better economic indicator, especially in relation to Ireland.)**

2. Why do we need to improve Resource Efficiency?

In recent years Ireland had been consuming materials at an unsustainable rate. While this has since been reduced, we are still well above the EU per capita average.

Relatively small efficiencies can now yield significant savings for the economy, benefitting **job retention and creation**, and Ireland should be aiming for these savings.

Calculations show that, for example:

1% reduction in material consumption spending would yield savings of about €464 million per annum.

5% improvement could yield savings of €2.32 billion per annum.

In terms of how much Ireland 'earns' per tonne of materials consumed (resource productivity), Figure 1 below, from 2010 data, shows how Ireland performs in relation to some other countries. Ireland, while having improved greatly from a figure of **€800 per tonne** in 2007, **to about €1,370 per tonne**, is still 'earning' less than half that of the UK and Netherlands per tonne of raw material, and is below the EU average of €1,544 per tonne.

However, as will be explained later, it is not always possible to properly compare different countries, which may have different economic structures e.g. one based on diamonds or finance, the other based on steel.

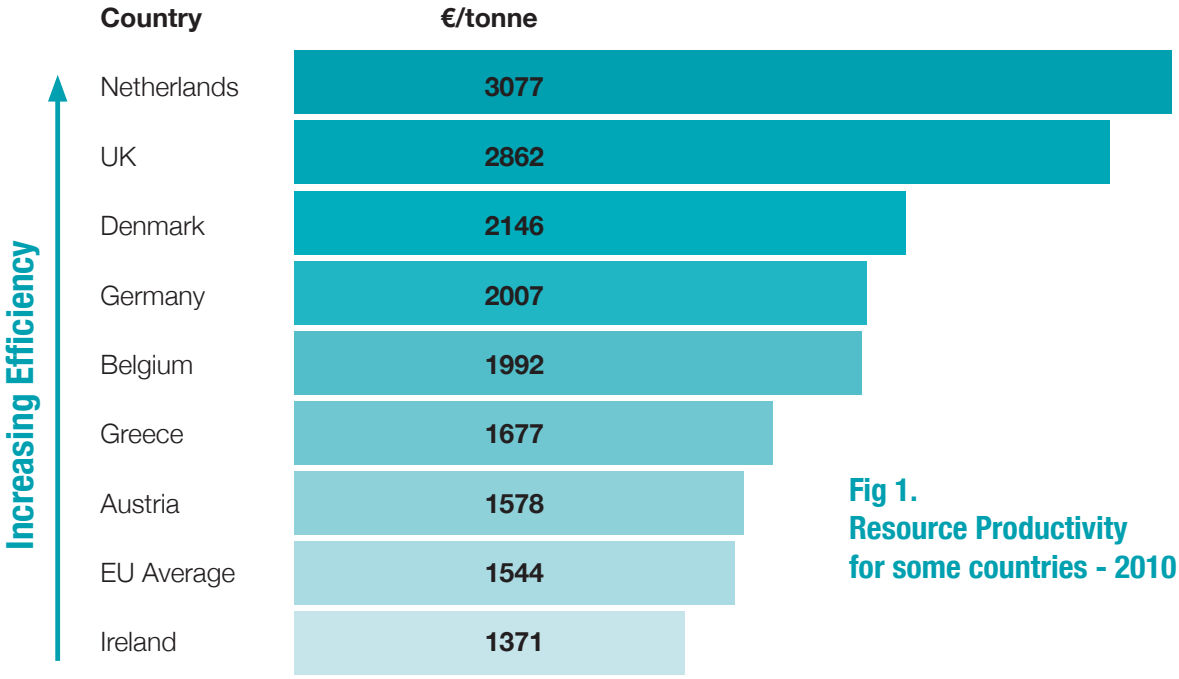


Fig 1.
Resource Productivity for some countries - 2010

In 2007, at the height of the Celtic Tiger, over 50 tonnes of material (DMC) was being consumed per capita in Ireland, which was over three times the EU average and the largest by far of any country. See Figure 2.

By 2010, due to the economic downturn in Ireland, the consumption had been greatly reduced. However, despite the financial crisis, Ireland was still one of the highest per capita consumers of materials in the EU - resources that are costing significant sums of money. See Figure 3.

This shows that in 2010, Ireland was still the 3rd highest consumer of raw materials per capita in the EU, behind only Cyprus and Finland. Ireland's consumption (in DMC) was about 25.5 tonnes per person (half of what it was 3 years previously), compared to the EU-27 average of about 16.5 tonnes per person. Much of this material ends up as waste or emissions.

It is essential, therefore, that the material consumption per capita for Ireland be lowered, and that systems be put in place to ensure greater efficiencies to reduce costs, and prevent waste, especially as the economy returns to growth.

Fig 2. EU 27 DMC for the year 2007

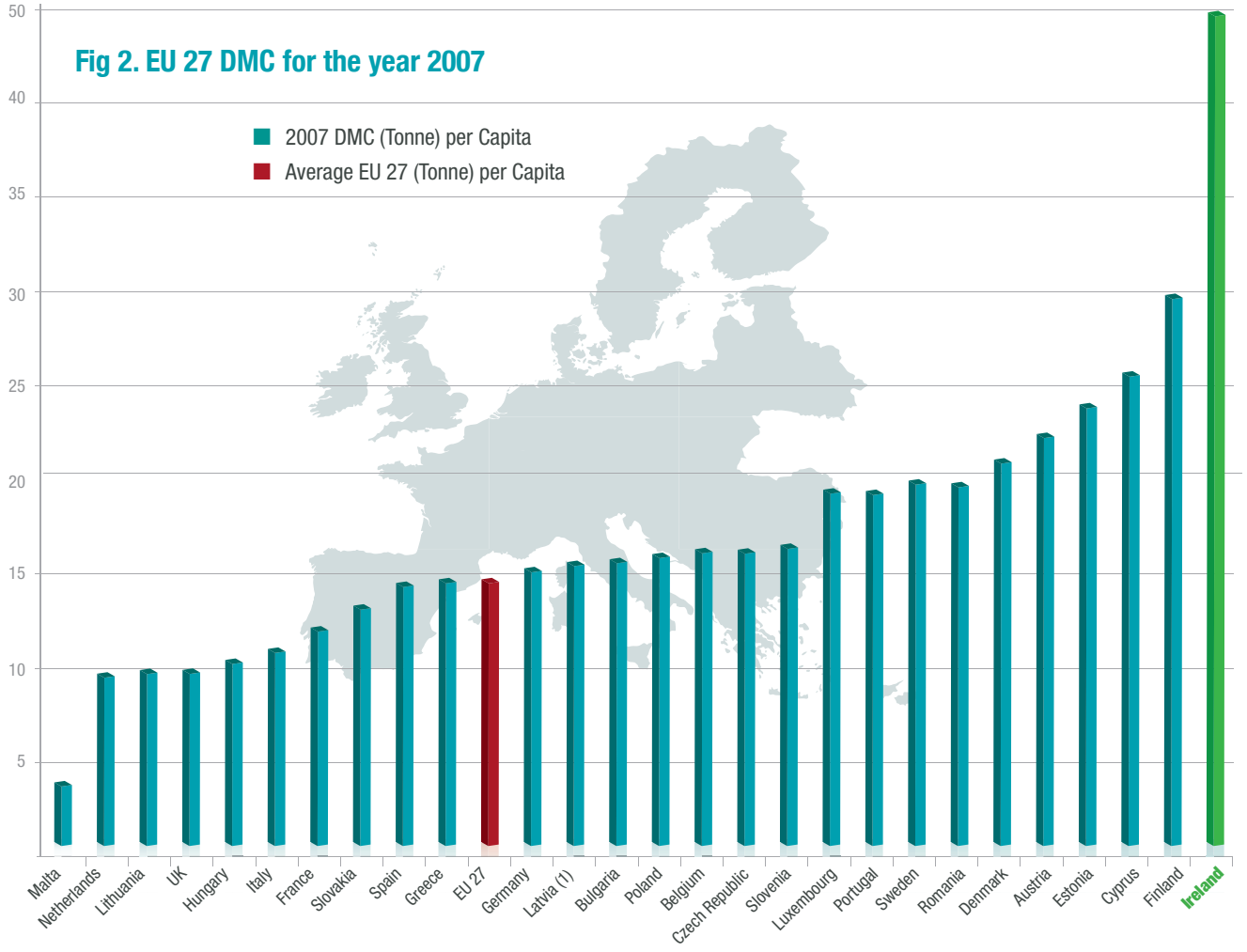
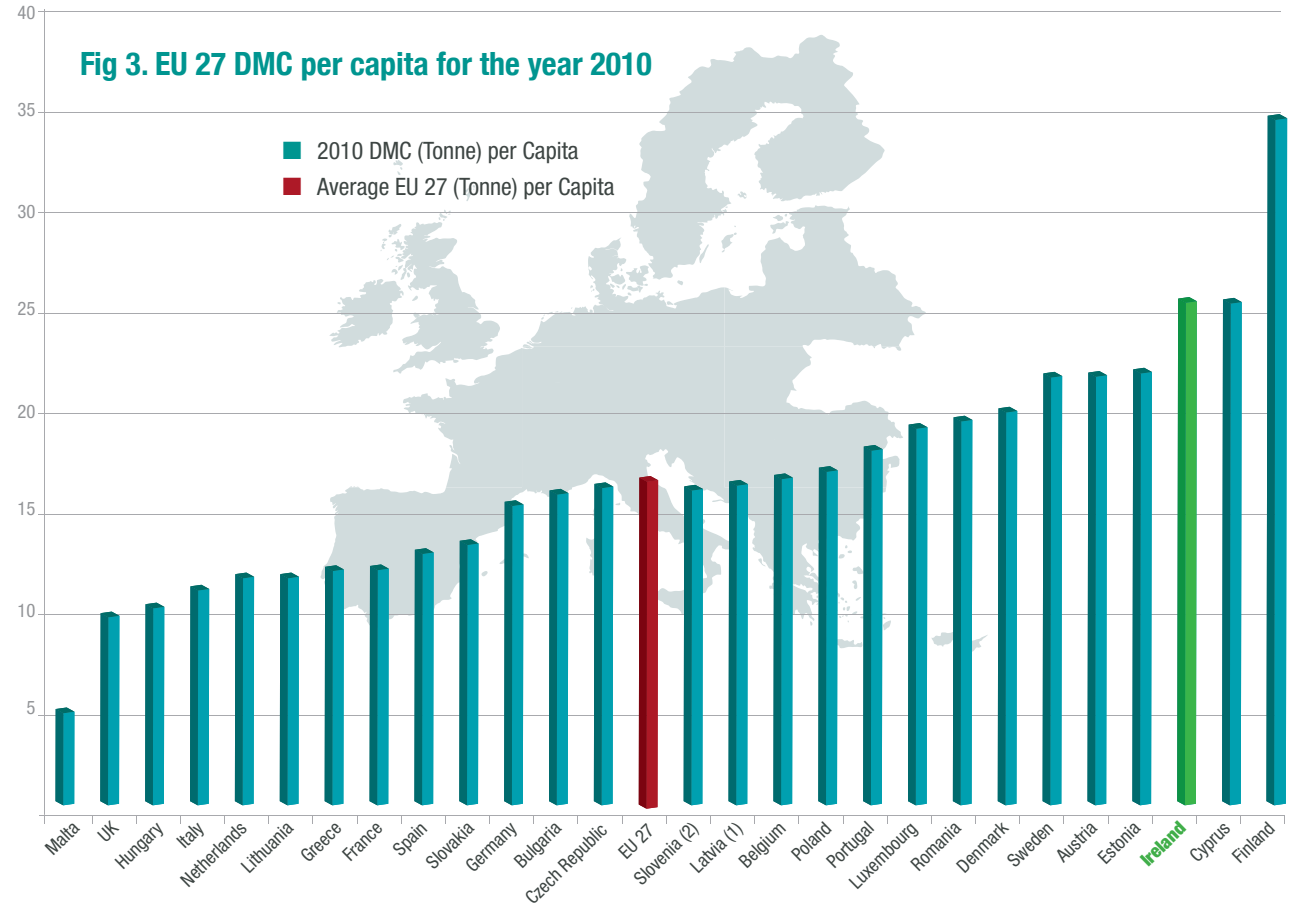


Fig 3. EU 27 DMC per capita for the year 2010



3. Resource Efficiency Roadmap - Backcasting

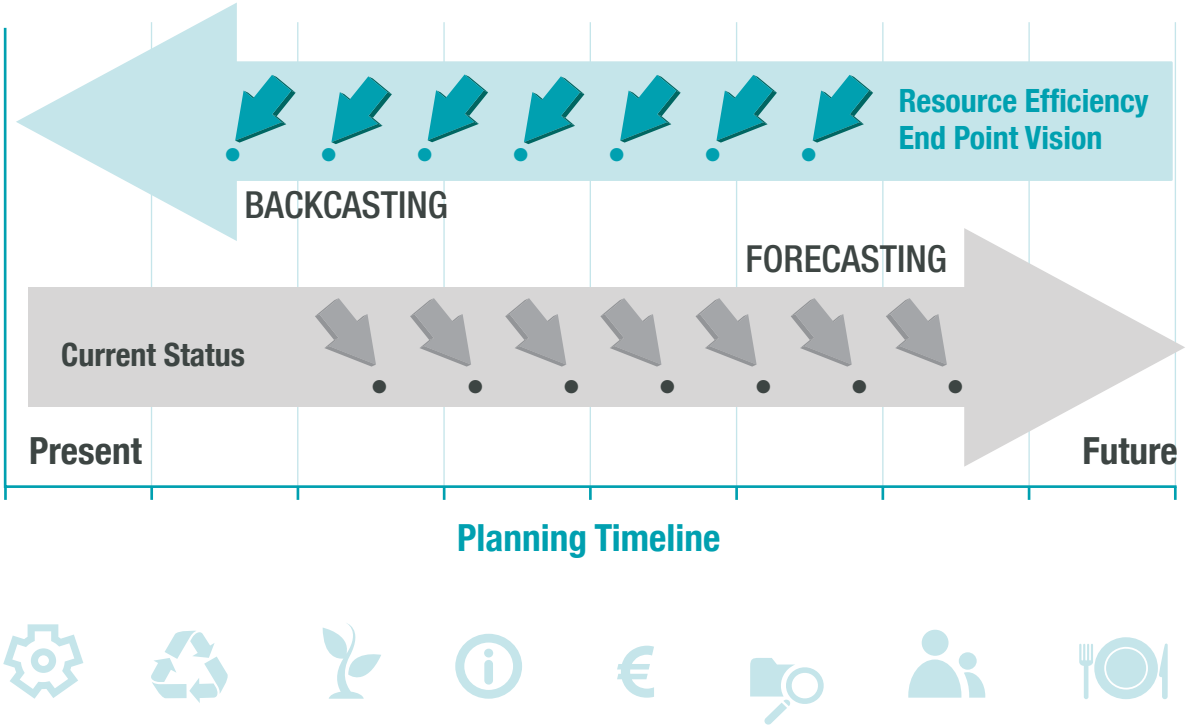
Roadmaps are used in a variety of applications. These include setting research agendas, product and technology plans, among others. In this instance the roadmap will set out the goals and plans for Ireland's Resource Efficiency, over a period of years up to 2020.

The methodology used in this roadmap is that of 'Backcasting'. This is a more innovative approach than 'Forecasting'.

Forecasting is based on an analysis of current trends, and because it suffers from the limitations of not knowing the end-point, it is falsely constrained by historical knowledge, and is a barrier to creativity and innovation.

The concept of backcasting is central to a strategic approach for sustainable development. It is a way of planning in which a successful outcome is imagined in the future, followed by the question: "what do we need to do today to reach that successful outcome?" This is more effective than relying too much on forecasting, which tends to have the effect of presenting a more limited range of options, hence stifling creativity, and more importantly, it projects the problems of today into the future.

In order to successfully engage in backcasting, some ideas of future targets and goals are necessary. These can be termed 'End-Points'. In order to reach these 'End-Points' it is necessary to achieve intermediary targets or 'Sub-Goals'.



Examples of possible 'End-Points'

The EC Communication on a Roadmap to a Resource Efficient Europe sets out such a set of principles or 'Vision'.

The Vision: By 2050 the EU's economy has grown in a way that respects resource constraints and planetary boundaries, thus contributing to global economic transformation. Our economy is competitive, inclusive and provides a high standard of living with much lower environmental impacts. All resources are sustainably managed, from raw materials to energy, water, air, land and soil. Climate change milestones have been reached, while biodiversity and the ecosystem services it underpins have been protected, valued and substantially restored.

Sub-Goals (Thematic Goals)

Within the chosen thematic areas the COM document presents a number of milestones and actions – each pertaining to a particular theme. Each of these has a 2020 deadline. This represents a six to seven year framework period, which is considered a suitable period for action. Thus, this document proposes such an action period.

Sample Sub-Goal (from EU COM (2011) 571)

Milestone: By 2020, waste is managed as a resource. Waste generated per capita is in absolute decline. Recycling and re-use of waste are economically attractive options for public and private actors due to widespread separate collection and the development of functional markets for secondary raw materials. More materials, including materials having a significant impact on the environment and critical raw materials, are recycled. Waste legislation is fully implemented. Illegal shipments of waste have been eradicated. Energy recovery is limited to non-recyclable materials, landfilling is virtually eliminated and high quality recycling is ensured.

Bringing it all together for Ireland

There are just a few steps to bringing all the elements of a Roadmap together using the backcasting method.

- Using the *2011 EC Communication 2020 Milestones*, the targets for resource efficiency can be set. These are modified and supplemented as appropriate.

- Based on the national and international review carried out by the research team, the current starting point is known. Analysing the inputs from widespread consultation in Ireland gives some idea of possible preferred routes and destinations.

- Bearing in mind that any activity is unlikely to start before 2014, this gives a six to seven year timeframe for the proposed activities to be implemented.

- Despite the intellectual appeal of the back-casting method, getting an exact picture of the situation 7 years ahead is difficult, and necessarily vague or blurred. Nevertheless, it is essential to aim for such objectives.

In order to introduce more clarity, it is proposed that the timeframe be broken onto shorter periods. The Recommendations in the Roadmap Summary Chart allocate the timeframe [illegible] recommendations, together with indicative costs of investment [illegible]um, and Long.

[illegible]herent, and comprehensive **Roadmap for a National Res[illegible]** [illegible] **Ireland** can be constructed.

[illegible] the [illegible] steered by the vision [illegible] 2020.

[illegible] applied from the

4. A More Detailed Look at Resource Efficiency

Resource Efficiency definition

Resource Efficiency has been defined earlier as:

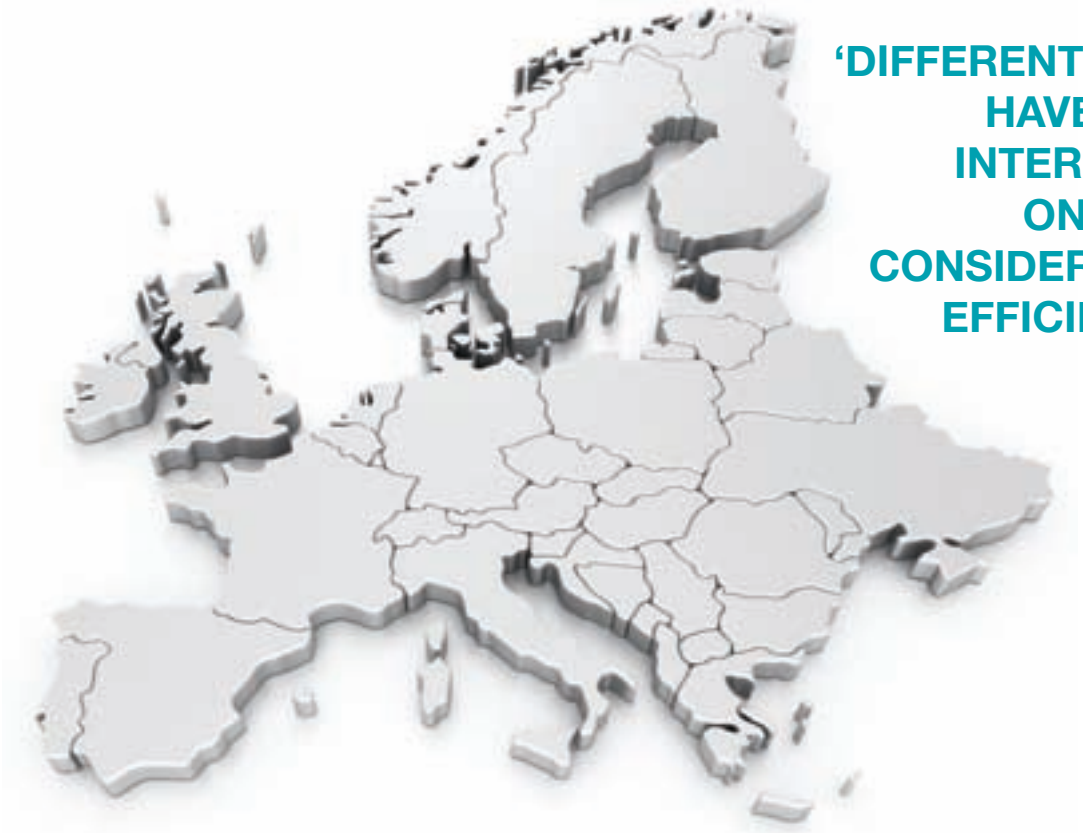
$$RE_{IRL} \cong RP = \frac{GDP}{DMC}$$

This is the definition used throughout this report. However, it is by no means the ultimate definition, and there are many problems associated with it.

Resource Efficiency (RE) has not been defined in any harmonised way. Different countries have different interpretations on what they consider resource efficiency to be. In its major study of resource efficiency in 31 countries, the European Environment Agency (EEA) found that only 5 countries defined "resources" and none defined "resource efficiency".

The EEA also states that: "in general, most country responses indicate quite a broad interpretation of the term 'resources', corresponding loosely to the all-encompassing definition of natural resources given in the EU thematic strategy on the sustainable use of natural resources."

Most attempts at definitions limit themselves to terms like Resource Productivity (RP) and/or Resource Intensity (RI). In keeping with most Resource Efficiency definitions in the literature, these concepts relate material flows and consumptions to some monetary measurement.



'DIFFERENT COUNTRIES HAVE DIFFERENT INTERPRETATIONS ON WHAT THEY CONSIDER RESOURCE EFFICIENCY TO BE'

Problems with the Ratio GDP/DMC

In its Resource Efficiency Roadmap Communication, the Commission proposed using resource productivity as the lead indicator, but requests a stepwise enlargement of the scope of this indicator. It recognises that using GDP/DMC is insufficient, since it does not take into account ecological rucksacks and unused extractions, nor does it include the 'effects' of production. Example 1 illustrates this point.

Example 1

Illustrative example of the problems with GDP/DMC

If an organisation makes a transition from steel beverage cans to aluminium cans, then for the same number of cans, there will be a three-fold decrease in material consumption (density difference between aluminium and steel). Therefore, the Resource Productivity would treble (all other things being equal) – even though no 'Real' improvements may have been made. *NB: There is no implication here that aluminium production has, or has not, a bigger environmental footprint than steel production. This is merely an illustrative example.*

Furthermore, no account has been taken of any associated extraction, purification, etc., effects. The manufacture of aluminium could well lead to an overall increase in environmental degradation, when full life cycle effects are considered. For this reason, choosing DMC as a denominator in any ratio, is a weak choice, and is the reason why the European Commission is anxious that the definition of Resource Efficiency be expanded to include the environmental rucksack of the flows though an economy. Measures of material flows, such as TMR (Total Material Requirement), are preferred – but at this moment are difficult to use.

Since GDP is measured in Euro and DMC in tonnes, the quotient, as it stands, is of relatively limited use – except to compare one year to the next. While it is commonly used for comparing countries (and we do so herein) it is far from ideal. See Example 2.

Example 2

Further example of the problems with GDP/DMC

We have all heard of the expression "comparing apples with oranges". In fact apples and oranges can be added – so three apples plus four oranges is seven fruit. It has not got too much meaning – but it serves some purpose. Dividing apples by oranges, however, has no meaning. The units are indeterminable – and would be different from those obtained by dividing apples by pears.

Likewise, dividing euros by tonnes gives a unit which is ultra-specific, and therefore of limited use. It depends on what the tonnes consist of.

For example, if an economy were based on the use of steel for manufacturing, then Resource Productivity would be based on tonnes of steel. If the economy changed to importing diamonds, then, clearly there would be a much lower value in tonnes for the same GDP. The resource productivity would be massively increased, but no real improvements would have been made. The situation is even more exaggerated if the economy changes to a service-based one (for example, financial services).

Thus, to compare the performance of countries with different economic structures is not feasible using measures such as resource productivity.

In order to make use of a measurement, such as GDP/DMC it is advantageous to convert DMC to some equivalent financial measure. This allows for two things, viz.,

- Making a distinction between tonnes of steel and tonnes of diamonds (as per fictitious Example 2), and more importantly,
- Determining the value to the country of improving the RP value.

For this report, therefore, the definition used will be: $RE_{IRL} \cong \frac{GDP}{DMCFIN}$

- where DMCFIN means that material consumption has been "converted" from tonnes to Euro.

[Note: GDP/DMC (where the latter is measured in tonnes) can be used where appropriate – for example, often DMC data is only available in tonnes. However, for the determination of the economic impact of Resource Efficiency improvements in Ireland, the 'financial' version will be used (i.e. DMCFIN). Note also that this is not an exact financial value of DMC per se, but rather an approximation of the value of Industrial Material Inputs to certain sectors as presented by the CSO for 2010: see Main Report for more details.]

5. Potential Savings and Targets

From the definition it is clear that an increase in resource efficiency means either an increase in GDP for the same economic value of material consumption, or a maintenance of GDP with a lower economic consumption – or a combination of both. This is the often-used phrase “more for less”.

Thus, improving Resource Efficiency results in economic benefit for a society. It remains then to:

1. Make some kind of estimate for these savings
2. Determine realistic targets
3. Propose a means of achieving these targets

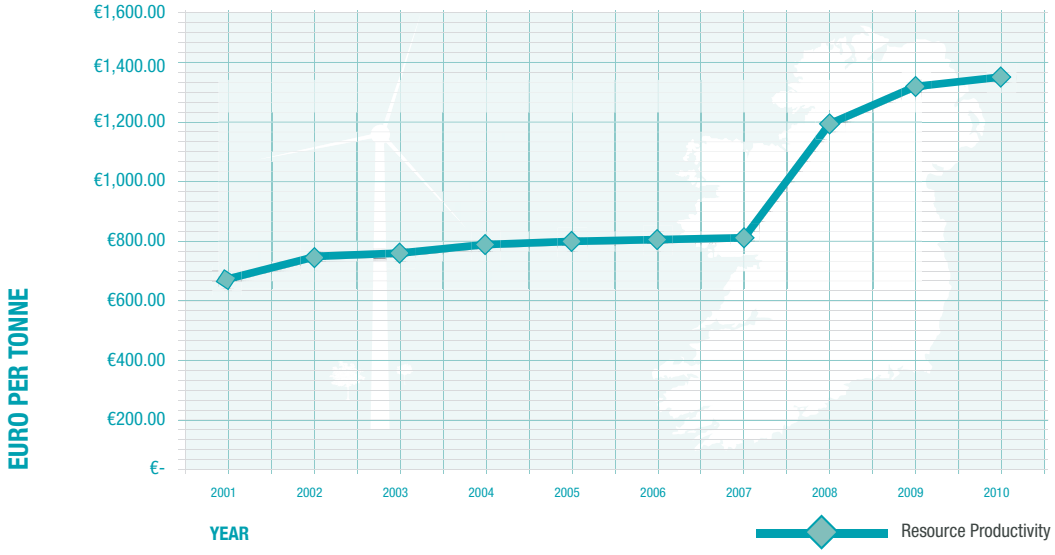
It should also be borne in mind that there are already published Commission targets and goals for many resource efficiency sub-sets.

Resource Productivity in Ireland

During the period 1994-2007, while Domestic Material Consumption in Ireland grew by around 250%, Gross Domestic Product grew by slightly more than this – so that Material Intensity decreased by about 2%. This means that Resource Efficiency (as defined in this report, i.e. measured as Resource Productivity) increased by 2%. At the same time, the EU-27 average value increased by 16%.

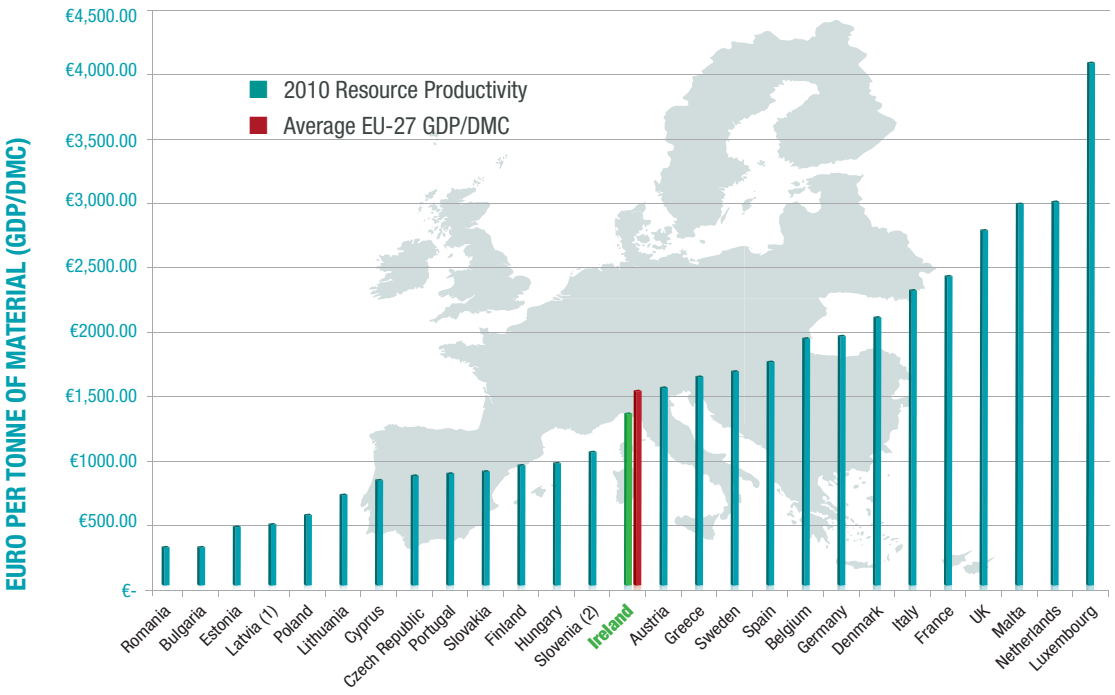
Since 2007, due to the economic downturn and the reduction in the construction industry in particular, Ireland’s resource productivity has increased, rising from about €800 per tonne to about €1,370 per tonne. This is mainly due to the huge drop in material consumption per annum and can be seen in Figure 4 below:

Fig.4 Ireland’s Resource Productivity 2001- 2010



However, despite these improvements, Ireland's resource productivity still does not compare favourably with many EU countries and is below the EU average of €1,544 per tonne. This is shown in Figure 5 below. As Ireland's economy begins to grow again, there is a strong requirement to ensure that productivity does not crash again to 2007 levels, but rather is improved upon.

Fig 5. Resource Productivity for EU27 for the Year 2010



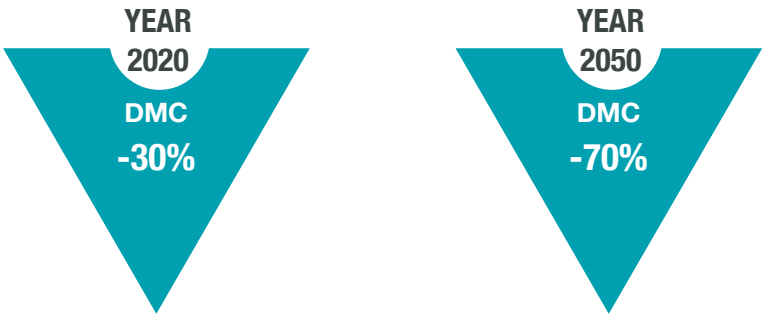
It should be noted that some countries which have very high resource productivity levels, have 'different' characteristics from those that do not. For example, the following quotation is from a recent study for the Commission:

"While most MS show relatively stable DMC and relative dematerialisation, some MS such as Germany and the United Kingdom have reached absolute dematerialisation, even in the long run [sic]. Absolute dematerialisation in most cases was a result of deindustrialisation and fading out of material intensive heavy industries, ***which is in fact the externalisation of material use and corresponding environmental impacts to third countries"*** *[our emphasis].*

Potential Targets

In its study for the European Commission, Bio Intelligence Service has recommended certain targets for resource efficiency improvement.
Figure 6 below shows the potential DMC targets (referenced to 2005):

Fig 6. Potential Targets for DMC Reductions from Bio Intelligence Service Report



Using 2005 as a baseline, there are 45 years until 2050. If GDP grows at 1.5% per annum, then the total growth = (1+growth/100)^45 = 1.015^45. If material use decreases by 70% (in accordance with the Bio Intelligence Service recommendation), then DMC in 2050 will be 30% of its 2005 value. Thus resource efficiency improvement will be 1.015^45/0.3 = 6.51.

Assuming a 1.5% annual growth rate, this leads to an increase in Resource Efficiency, on a domestic material consumption basis, of:

(1.015)^15/0.7 = 1.79 by 2020, and

(1.015)^45/0.3 = 6.51 by 2050

(and similar calculations on other bases).

FACTOR X

Practitioners of Resource Efficiency often speak about ‘Factor 2’, Factor 10’, and generically, ‘Factor X’. Factor 2 means that the same level of service is achieved, using only half the resources. Factor 10 means that the same level of service is achieved, using only one-tenth the resources.

Some values for resource efficiency improvements (in DMC) and associated Factor (X), based on other economic growth rates (GR = Growth Rate) are shown in Table 1 below, for 15 years and 45 years respectively.

With a 30% reduction in DMC and 2.5% annual GDP growth rate, Factor 2 would be achieved in 15 years (shaded row), while Factor 10 can be achieved within 45 years at the same growth rate and a 70% reduction in DMC (2nd shaded row).

Therein lies one of the flaws in this type of analysis. Improved resource efficiency is easier to achieve at higher growth rates. For example, if the Irish economy remains stagnant until 2020, the improvement associated with a 30% reduction in DMC will only be 43%. In order to achieve Factor 2 at zero growth rate, the required DMC reduction is [(1 + GR)^15/2] = 50%.

However, for the above analysis the Bio Intelligence suggested targets of 30% and 70% (corresponding to 2020 and 2050 respectively) have been used in Table 1.

GR (annual % Growth Rate	n (number of years)	(1+GR) ∧ n	%DMC Reduction	Factor X
0	15	1.000	30	1.43
1	15	1.161	30	1.66
1.5	15	1.250	30	1.79
2	15	1.346	30	1.92
2.5	15	1.448	30	2.07
3	15	1.558	30	2.23
3.5	15	1.675	30	2.39
4	15	1.801	30	2.57
5	15	2.079	30	2.97
GR (annual % Growth Rate	**n (number of years)**	**(1+GR) ∧ n**	**%DMC Reduction**	**Factor X**
0	45	1.000	70	3.33
1	45	1.565	70	5.22
1.5	45	1.954	70	6.51
2	45	2.438	70	8.13
2.5	45	3.038	70	10.13
3	45	3.782	70	12.61
3.5	45	4.702	70	15.67
4	45	5.841	70	19.47
5	45	8.985	70	29.95

Table 1: Perceived Levels of Activity to Achieve Targets

The Bio Intelligence Service study adds further information, in respect of the perceived levels of activity required to meet Ambitious, Moderate or Conservative resource efficiency targets. For material use (DMC), for example:

Perceived Levels of Activity to Achieve Different Target Levels

Ambitious
★★★
30% by 2020
70% by 2050

Possibility to achieve targets with significant changes in levels of activity and significant advancement from known and future technologies

Moderate
★★
10% by 2020
30% by 2050

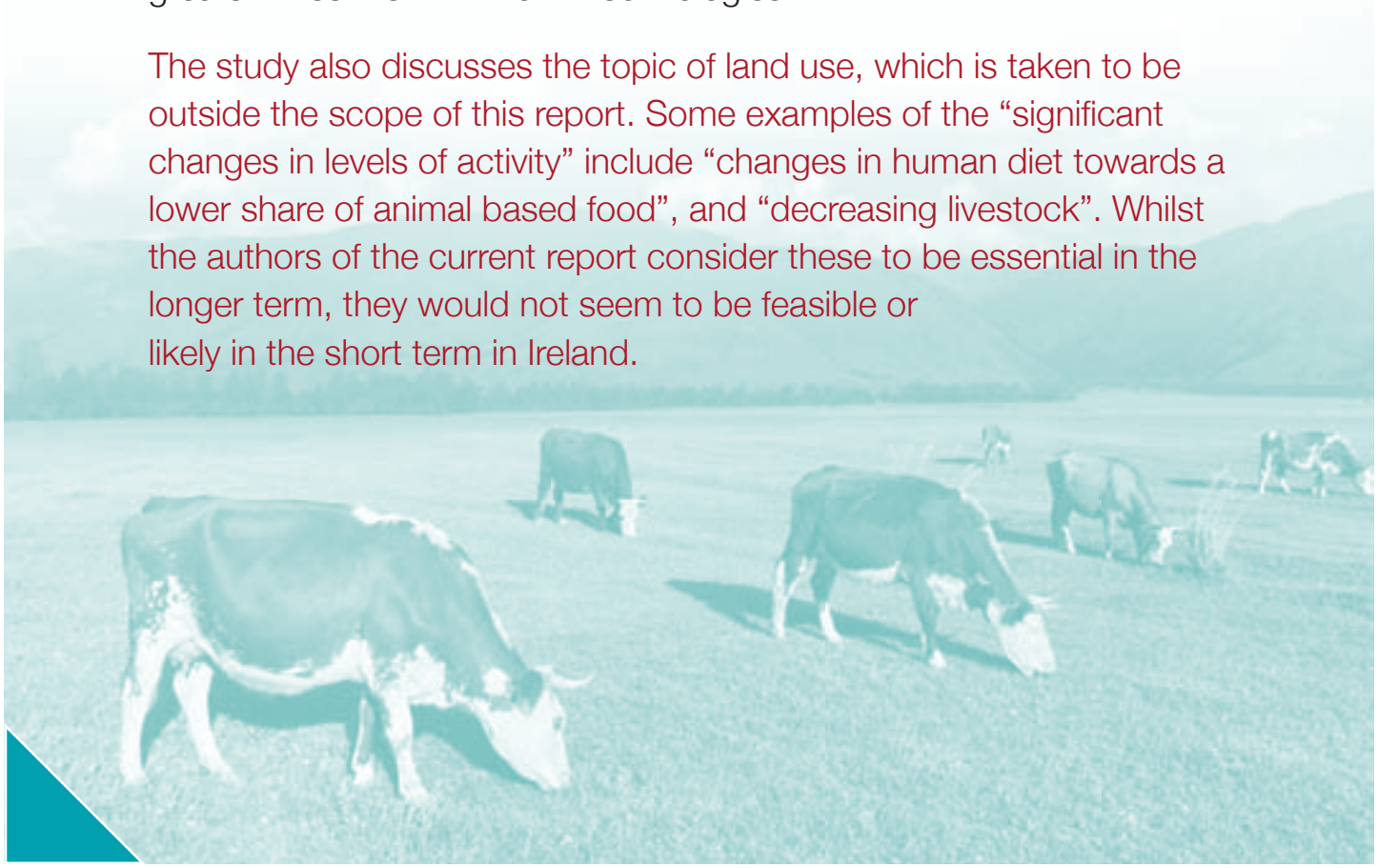
Possibility to achieve targets with slight changes in levels of activity and greater investment in known technologies

Conservative
★
5% by 2020
20% by 2050

Possibility to achieve targets while maintaining current levels of activity and cost-effective investments in known technologies

The study claims that moderate improvements in resource efficiency could be achieved by only 'slight changes in levels of activity and greater investment in known technologies'.

The study also discusses the topic of land use, which is taken to be outside the scope of this report. Some examples of the "significant changes in levels of activity" include "changes in human diet towards a lower share of animal based food", and "decreasing livestock". Whilst the authors of the current report consider these to be essential in the longer term, they would not seem to be feasible or likely in the short term in Ireland.



Potential Cost Savings for improved Resource Efficiency

In the UK and Germany estimates have been made for potential savings for resource efficiency.

In the UK, the potential resource efficiency savings, for No Cost/Low Cost initiatives are estimated at €26.2 billion. The resource efficiency savings opportunities with a payback of over one year are estimated at €38.4 billion.

Thus, the potential resource efficiency savings in the UK range from **€26 billion to €65 billion**, depending on the level of investment.

In Germany, it has been reported that there are **potential savings of €48 billion per annum** due to material efficiency efforts in companies from the manufacturing industry alone.

Comparing German, UK, and Irish GDP, Figure 7 below gives some indication of how these predictions may be translated into the Irish situation:

Fig 7 Predicted Potential Savings In Ireland Based on UK and German Data

Estimate of Irish DMCFIN and Potential Savings in Ireland

First pass estimates for material consumption in Ireland in financial terms (called DMCFIN) have been made for Ireland, using industrial input financial data for several sectors and the public sector from 2010 CSO data – the methodology is described briefly below and in more detail in the Main Report. Whilst the Clean Technology Centre has the capacity to so do, it is outside the scope of this study to perform a detailed economic analysis. It would seem very prudent, however, that such a study be undertaken.

The total estimated Private Sector Inputs in 2010 is estimated at €40.52 billion per annum.

The total estimated Inputs by Public Bodies = €15 billion. This is broken down into: GOODS AND SERVICES – €9 BILLION; CAPITAL WORKS – €6 BILLION

It is not possible, at this juncture, to determine exactly how much of this €15 billion is accounted for by materials, and this report will be recommending that ascertainment of this value be an early priority for any Irish resource efficiency programme.

However, as a conservative, indicative estimation, it will be assumed that only 25% of the capital works is spent on raw materials, and 50% of procurement is spent on materials. This gives a material consumption spend of (6*0.25)+(9*0.5) = €6 billion. This figure is used for the following indicative, illustrative calculations.

With such a large spend on raw materials in Ireland, even modest efficiencies (of 1% or 5%) can achieve substantial year-on-year savings for Ireland in a time where every economic boost can help the country.

It is estimated that:

- A 1% improvement in resource efficiency would achieve an initial saving of €464 million per annum;

- A 5% improvement would achieve an initial €2.3 billion annual saving.

Table 2 shows the potential financial savings (in the private and public sectors) in Ireland for various levels of material consumption reduction, from 1% (€464 million per annum) to 20% (€9.28 billion per annum):

Material Consumption Reduction	Annual Savings (€million) – Private Economy	Annual Savings (€million) – Public Sector	Annual Savings (€million) -
1%	404	60	**464**
2%	808	120	**928**
5%	2,020	300	**2,320**
10%	4,040	600	**4,640**
15%	6,060	900	**6,960**
20%	8,080	1,200	**9,280**

Table 2: Potential Savings for Resource Efficiency Improvements

Potential resource efficiency targets for Ireland

Very few countries have set targets for Resource Efficiency. Two exceptions are Austria and Germany.

Both Austria and Germany have set targets of 50% increase in resource efficiency (i.e. doubling of efficiency) by the year 2020.

Austria has set a target of Factor 4 by the year 2050 and Germany has set a target of Factor 4 for 'long term' (not defined).

In order to fully assess the magnitude of material consumption associated with any Resource Efficiency targets, it is necessary to assume a growth rate for GDP and factor that in to calculations. These can be seen in Table 3 below. As of January 29th, 2013, the Central Bank forecast for economic growth for Ireland was that GDP would grow by 1.3% in 2013.

Assuming modest 1.3%, 1.5%, 2%, and 3% growths in GDP in Ireland over the coming years, allows calculation of the decreases in material consumption required to achieve a conservative target of 25% (half the targets of Austria and Germany) of resource efficiency.

GDP Growth level (%)	Material Consumption Reduction (2020 target of 25% improvement)	
	Total Reduction by 2020 (%)	Annual Reduction (%)
0	-20.0	-3.1
1.3	-12.4	-1.9
1.5	-11.2	-1.7
2.0	-8.1	-1.2
3.0	-1.6	-0.2

Table 3: Impacts of GDP Growths on Material Consumption Targets For 20% Improvements in Resource Efficiency

Thus a moderate target for Resource Efficiency improvement could be set at 25% by 2020, and a more ambitious target of at least Factor 4 by 2050.

These could result in the following national savings (indicative figures only), by 2020, of:

Irish industry/private economy:	Public Spending:
€6.1 billion	€900 million

To achieve this, a relatively modest annual material consumption reduction of between 0.2% and 1.9% would be required – depending on the annual growth in GDP. The above values were calculated using a growth rate of 1.3% per annum - leading to a required material consumption reduction of 1.9% per annum. We have rounded this target up to 2% per annum for simplification in the Recommendations and Headline Findings. It should be noted that this is without any reduction in output and would be achieved solely by improved efficiency.

All the above calculations are examples, given solely to set a framework for decision-making, and should be determined more accurately and comprehensively by policy-makers.

6. Legislative and Policy Basis for Resource Efficiency

European Legislation and Policies for Resource Efficiency

At the European level, many policies, strategies and initiatives are in place to improve resource efficiencies.

Europe 2020: A Strategy for smart, sustainable and inclusive growth (2010), is the European Union's ten-year growth strategy aimed at overcoming the current financial crisis in a way that adjusts the current societal growth model to facilitate conditions for a different type of growth that is smarter, more sustainable and more inclusive.

The Resource-Efficient Europe Initiative (COM (2011) 21) is a cornerstone initiative of Europe 2020 and the *Communication: Roadmap to a Resource Efficient Europe* (COM (2011) 571) provides some detail on what the European Commission is seeking in this regard.

Prior to the roadmap, other initiatives have been supporting resource efficiency. For example, the *6th Environment Action Programme (6EAP)* aimed for 'Better resource efficiency and resource and waste management to bring about more sustainable production and consumption patterns, thereby decoupling the use of resources and the generation of waste from the rate for economic growth and aiming to ensure that the consumption of renewable and non-renewable resources does not exceed the carrying capacity of the environment'.

A major pillar of 6EAP was the *Thematic Strategy on the Sustainable Use of Natural Resources* that was published in December 2005. *An Action Plan on Sustainable Consumption and Production (SCP)* was issued in 2008, building upon previous resource efficiency measures, but also developing further life cycling thinking and material-based analysis and targets.

With regard to waste prevention (which is closely linked with resource efficiency) and better waste management, other major EU initiatives included:

- *Waste Framework Directive* (revised)
- *Thematic Strategy on the prevention and recycling of waste*
- *WEEE Directive* (revised)
- *Packaging Directive* (revised)
- *Batteries Directive*
- *Landfill Directive* and *Council Decision of 19 December 2002* establishing criteria and procedures for the acceptance of waste at landfills
- *Mining Waste Directive*

The European Commission has agreed on a new **(7th) Environment Action Programme** to guide EU environmental policy up to 2020.

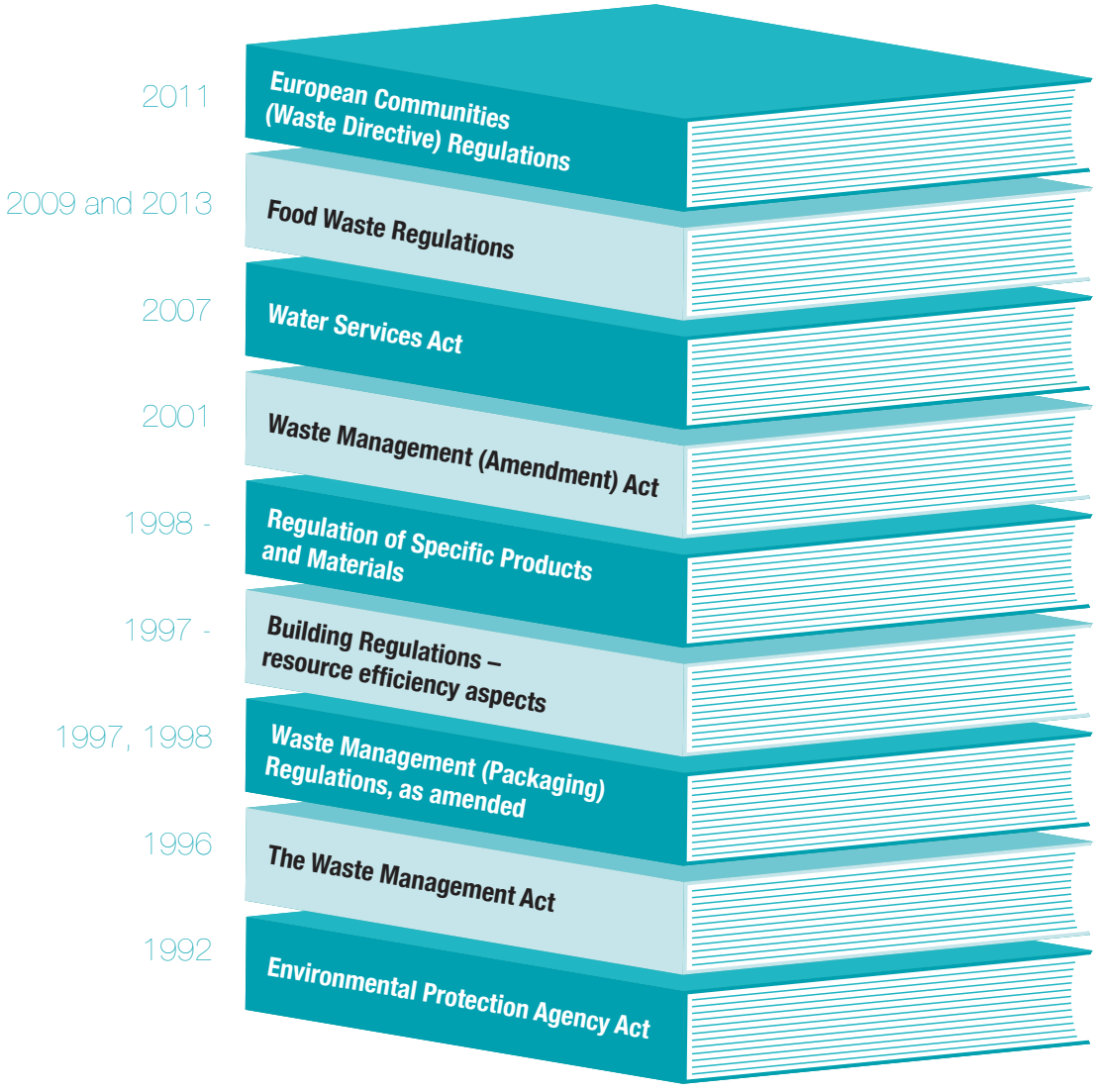
Irish Legislation and Policies for Resource Efficiency

Ireland has a very solid legislative foundation upon which resource efficiency policies, programmes and initiatives can be built. Most of these laws and regulations give Ministers, Governments and public agencies adequate powers to protect the Irish environment and meet European Union commitments.

The legislation covers a wide range of material streams, water and energy. In almost all cases (except perhaps the essential 'prevention' requirements of the Waste Management (Packaging) Regulations the legislation appears to be well implemented; this is also the case in other EU member states.)

The administrative system set in place under the EPA Act 1992 has delivered a huge range of environmental protection and resource efficiency measures, and is supplemented by local authority supports.

Irish Environmental Legislation Supporting Resource Efficiency



Since 1998, Irish Governments have prepared and published many different strategies and policy documents in relation to wastes and material flows.

In earlier years the main focus on these was at the end of life stage of materials and products, but now the trend is to move higher up the life cycle chain.

- 2012 Delivering our Green Potential, a Policy Statement on Growth and Employment in the Green Economy
- 2012 A Resource Opportunity: Waste Management Policy in Ireland
- 2012 Our Sustainable Future
- 2012 Strategy for Renewable Energy 2012 -2020
- 2012 Green Tenders: An Action Plan on Green Public Procurement
- 2009 Maximising Ireland's Energy Efficiency – The National Energy Efficiency Action Plan 2009 – 2020
- 2008 National Hazardous Waste Management Plan
- 2007 The National Climate Change Strategy 2007-2012
- 2006 National Strategy on Biodegradable Waste
- 2002 Preventing and recycling waste
- 1998 Waste Management: Changing our Ways

Irish environmental policies and strategies supporting resource efficiency

However, while in theory there is a focus on waste prevention and life cycle issues, in reality full life cycle approaches and full internalisation of external costs are rarely implemented. This is especially true of material flows and products not sourced in Ireland.

Also, in relation to sustainable development, there have been many ambitious and far reaching strategies over the years but full implementation of these has not occurred.

With regard to hazardous waste, the national plans have delivered several useful initiatives under the National Waste Prevention Programme, but this should be intensified, with further prevention based actions, as well as Producer Responsibility Initiatives (PRI), onsite treatments etc.

Ireland is particularly challenged in the areas of eco-labelling, green public procurement and eco-design. While there are obvious difficulties in developing eco-labels and ensuring sustainable design, due to the nature of its open economy, green procurement by public agencies is within our control and must be urgently implemented.

The new 2012 waste management policy *A Resource Opportunity: Waste Management Policy in Ireland* is a welcome development and, if fully implemented, can facilitate major progress in many resource efficiency areas. **Full and swift implementation of the policies and proposed measures in that document is highly recommended.**

Other Irish policies (economic etc.)

As well as the many environmental legislative supports and initiatives outlined, there are several other major national strategies and policies in place relating to economic growth and sectoral consolidation which implicitly or explicitly require resource efficiency as a core foundation for Ireland.

While these policies are diverse and relate to different topics such as the economy, jobs, food, water etc., they all have the underlying principle in place that Ireland needs to do more with less.

Waste must be reduced in all areas of society and all sectors need to become more resource efficient. This is required as a matter of urgency, given the economic difficulties Ireland is currently facing.

It is clear that these and other Government strategies and action plans are at one with the recommendations laid out in this report and the findings of the research in this project in relation to resource efficiency. Resource Efficiency is not only an environmental imperative, but it is also vital to ensuring Ireland's economic recovery. And, as previously stated, relatively modest resource efficiency improvements in Ireland can lead to significant economic savings.

Other Irish policies and plans supporting resource efficiency

2012
Report of the Research Prioritisation Steering Group

2012
Action Plan for Jobs

2012
Supporting Economic Recovery and Jobs - Locally: Sectoral Strategy of the Local Government Sector to promote Employment and Support Local Enterprise -

2012
Our Ocean Wealth – Towards an Integrated Marine Plan for Ireland

2012
Reforming Water Services to Meet Ireland's Future Economic and Environmental Needs

2011
Food Research Ireland – Meeting the needs of Ireland's food sector to 2020 through research and innovation

2011
National Reform Programme for Ireland under the Europe 2020 Strategy

2010
The National Recovery Plan 2011 – 2012

2010
Food Harvest 2020 – A vision for agri-food and fisheries

2009
Smarter Travel – A sustainable transport future – A New Transport Policy for Ireland 2009 – 2020

2006
Bioenergy Action Plan for Ireland – Report of the Ministerial Task Force on Bioenergy

2002
National Spatial Strategy for Ireland 2002 – 2020 – People, Places and Potential

7. Resource Efficiency in Ireland

There are many and varied initiatives to support resource efficiency in Ireland. These are wide-ranging in focus and a large number of target groups in society are being supported. When compared with other countries, especially those of a similar scale and socio-economic status, Ireland can be said to be implementing worthwhile and effective resource efficiency programmes. However, greater integration of the programmes in place and greater intensification of their scope and scale are required.

EPA and the NWPP

The EPA is implementing a comprehensive and wide-ranging set of programmes in Ireland as part of the National Waste Prevention Programme (NWPP). This suite of support schemes provides economic aid, awareness-raising measures, and technical advice to many different intermediary agencies and organisations. These in turn interact with the public, companies and local authorities to prevent waste and develop resource efficiencies. Direct aid is also offered to businesses through programmes, such as the Cleaner Greener Production Programme (now Green Enterprise). However, the level of supports and investment allocated to NWPP is not currently adequate, given the types of potential savings and resource efficiencies possible outlined above and the scale of some supports in other countries described below.

It is vital that NWPP be further developed and expanded, especially in view of the 2012 Government policy document (*A Resource Opportunity: Waste Management Policy in Ireland*), the *EU Roadmap on Resource Efficiency*, not to mention requirements under the *EU Waste Framework Directive*. The economic returns from NWPP have also been very impressive, achieving savings many times in excess of its cost. Its work should also be integrated in a more focused approach with other national programmes in place. New sectors should be tackled, new materials flows targeted, new tools developed to support companies, communities, local authorities et al. The NWPP can develop support materials for green procurement, eco-design, and life cycle thinking with support from the intermediaries in place. More detailed recommendations are made below.

SEAI

SEAI has many support mechanisms to reduce energy wastage and subsequent emissions. These programmes are tailor-made to different target groups such as large energy users, public bodies, SMEs, schools and the general public and are very significant. A large body of knowledge and experience has been developed by SEAI to provide back-up and correctly direct resources and actions. SEAI programmes are vital to increase energy efficiencies, develop the use of renewables and prevention of emissions. These should be further expanded and developed and integrated with the other support programmes in place.

Resource efficiency initiatives in Ireland by organisation

Organisation/ Programme	Initiatives	
EPA/NWPP	Green Hospitality	Local Authority Prevention Network (LAPN)
	Green Business Initiative	Packaging Waste Prevention Programme
	€co-Cert	StopFoodWaste Programme (SFW)
	Green Healthcare	Community Reuse Network (CRN)
	SMILE B2B reuse scheme	Greening Communities
	Green Retail	Green Your Festival
	Green Home	Green Enterprise (formerly Cleaner Greener Production Programme (CGPP))
	Green Defence Forces	Smart Farms Programme
Enterprise Ireland	Green Offer	ISO 14001 & EN16001
	Green procurement	Carbon management strategies
	Ecolabels	Assistance with processes and products
	www.envirocentre.ie	
SEAI	Homes: Power of One	Homes: Better Energy Homes
	Homes: Warmer Energy Homes	Public sector: best practice
	Public sector: partnership agreements	Public sector: reporting guidance
	Public sector: funding, financing and procurement	Large Users: Energy Agreements Assessments Programme
	Large Users: Large Industry Energy Network (LIEN)	Schools: supports and "One Good Idea"
	SME: several supports (advice, tools, training etc.)	Renewable Energy: several supports
	Communities: Sustainable Energy Communities	
Forfás/DJEI	Green Economy Programme	
IDA Ireland	Clean Technology and other supports	
BIM	EMS supports	Green Seafood Business Programme
Bord Bia	Origin Green	
Teagasc	Resource efficiency research in Agriculture	
EPA & others/ Research	STRIVE	I2E2, Strategic Research Cluster, IERC, Atlantic Marine Test Site, SFI, HEA, SEAI etc.
rx3/Recycling	Technical, economic and communication supports	
An Taisce/ Schools	Green Schools	Green Campus
Crosscare, BIA	Foodbanks	
Local Authorities	Regional Waste Management Plans	
Government/ PRIs	Packaging, farm plastics, C&D waste, WEEE, ELVs, Tyres, Batteries	
Freetradeireland	Online reuse service	
Government	Pay by Use Collection of domestic waste	

Enterprise Ireland

Enterprise Ireland also supports client companies with a range of programmes, and information products on several environmental topics such as ecolabels, environmental management systems and green procurement. This scheme requires financial and staffing support to maintain its impact into the future. The current EI thinking of sectoral approaches is worthwhile and should be further built upon and the current supports for eco design, eco labels etc. should be intensified.

Food Programmes

Sector specific programmes in the food and fish sectors are being implemented by BIM, Teagasc and Bord Bia and these are of vital strategic importance, delivering real results and potentially very useful benchmarks and data. While Origin Green is still at an early stage, initial responses from the sector look promising. The research of Teagasc can provide long-term rewards for this sector, developing new resource efficiency and food waste prevention techniques. Such programmes should be replicated in other sectors, such as construction, ICT, specific manufacturing sectors, specific service sectors, SME clusters, etc. with co-operative approaches between the companies in the sectors and the umbrella bodies in place.

Symbiosis and Integration

There are already good relationships and interactions between the different business supports in place in Ireland, described above. However, this should be even further developed to avoid duplication, prevent potential barriers to SMEs and increase effectiveness. Likewise, the interactions in schools from LAPN, local authority education officers, Green Schools and Campuses and SEAI should be coordinated in a more effective manner. Such symbioses within the suite of programmes in the NWPP should also be further developed.

Green Public Procurement (GPP)

While there is a detailed and worthwhile plan in place for green public procurement with ambitious targets, there has been no major progress reported in its implementation to date. Furthermore, as can be seen below, GPP has now been streamlined in several countries and high levels of implementation are apparent, and Ireland is somewhat behind. GPP implementation in Ireland needs to be greatly prioritised and intensified across all Government departments. Consideration in green procurement must also be given to reducing the worldwide social and environmental impacts of Ireland's consumption - not only those within the country. Likewise, many of the proposed actions to reduce Ireland's climate impacts and to support its move towards a more sustainable development should be further developed in the near future.

The Recycling Economy

Some success in segregating and recovering waste streams has been achieved in Ireland in recent years, by producer responsibility initiatives (PRIs) and improved domestic and commercial collection schemes and infrastructures. There has also been success in reuse programmes, through the work of SMILE, Community Reuse Network and FreeTradeIreland. However, much more can be achieved through quick implementation of a nationwide domestic food waste segregation programme, better pay by use collection schemes, and an expansion of PRIs to include new material streams such as newsprint, magazines, office paper, hazardous wastes etc. The recovery benefits of implementing bring back schemes for some packaging items such as glass, aluminium and PET should be periodically reviewed. While not recommending a levy on all packaging, economic instruments such as levies in relation to single use cutlery and drink containers (e.g. tea/coffee, beer etc.) could greatly induce resource efficiencies on these growing waste streams. Bans could be imposed on the use of such items in major events, sporting fixtures etc. Large scale and consistent recovery of material streams would enhance the potential for indigenous reprocessing of paper, plastics etc. as well as making commercial composting and anaerobic digestion more viable - also supporting new jobs in the green economy. The work in the reuse sector also needs to be given further support and new initiatives begun, such as those in Belgium, Austria etc. Again, Ireland's record in this regard, while improving all the time, is somewhat behind other countries as highlighted below.

Research:

While there are notable achievements in the results from ERTDI/STRIVE and other research, these need to be further developed and expanded - with a greater focus on supporting green procurement, eco-design, life cycle approaches, reuse systems, bring back schemes etc. When compared to some of the research programmes on resource efficiency, such as those in Austria, for example Ireland needs to invest more.

Regional Waste Management Plans

While some good work is being done by the Limerick Clare Kerry Regional Waste Management Office, local authority environmental education officers and through the LAPN, this needs to be greatly expanded. Many of the commitments in the previous tranche of waste management plans have not been met. The next iteration of plans now under the new regional schemes must give a real commitment to leading by example through green procurement and provide dedicated staff to interact with businesses and communities in the development of resource efficiencies in their regions.

8. Resource Efficiency Elsewhere

There are many examples of resource efficiency supports and practices in other countries and regions and the project team carried out an extensive survey of these.

While some countries such as Austria, Germany, Netherlands and Japan have specific national resource efficiency plans, others have incorporated practices into regional plans or are implementing individual initiatives on a more ad hoc basis.

The many initiatives identified in the research have been reduced in number and detail in this report. These are available in the main project report, and in other project deliverables. Priority has been given herein to those with replicability in Ireland and where Ireland's suite of programmes can be further enhanced.

In this document these initiatives have been categorised as follows, and are summarised below:

- **Resource Efficient Production**
- **Recycling Economy**
- **Research**
- **Green Public Procurement**
- **Life Cycling Thinking**
- **Awareness Raising**

Resource Efficient Production

There are many different supports and initiatives for resource efficient production around the world, some of which are listed below:

Country	Initiatives
United Kingdom	Waste prevention loan fund, Courtauld Commitment, other WRAP supports
Basque region	Eco-efficiency programmes for industry
Austria	Ecobusiness plan Vienna, Ecoprofit, klima:aktiv, chemical leasing
Norway	ENOVA – energy supports
New Zealand	Target Sustainability (Christchurch), Sustainable Tourism advisors (regional)
Germany	Effizienz-Agentur NRW North Rhine-Westphalia support scheme; Material Efficiency Agency

Some of the characteristics of these initiatives are interesting from an Irish perspective. The use of sector-focused supports has been found useful in many countries - for example: *The Courtauld Commitment* focuses on the grocery retail sector in the UK.

Programmes to focus on a specific product or material stream are also considered effective - for example the chemical leasing scheme of Austria.

What is most striking for some of the most effective programmes is the scale of the investment. For example, in just one subsection of the *Effizienz-Agentur NRW North Rhine-Westphalia Business Support Scheme*, the agency has invested €39.8 million working with 548 companies - this is a significant scheme providing substantial resource efficiency assistance.

By 2001 in the Austrian *klima:aktiv* programme there were almost 300 business partners, more than 5,000 implementation partners and 2,500 competence partners (training and R&D) in the network. More than 6,000 people have taken part in *klima:aktiv* training. There are 820 flagship projects in the sector of sustainability available in the building database. Around 2,500 consultations have been carried out since the programme was launched in the year 2005. This constitutes a major investment for the future. Ireland needs to move towards such a substantial scale of investment in resource efficiency.

Recycling Economy

Many countries have implemented schemes and initiatives to improve material recovery, reuse and recycling, whether legislative, economic, awareness-based etc. Some of these are listed below.

Country	Initiatives
Germany, Finland, Norway, Denmark, Sweden, Estonia	Deposit schemes, bring back schemes for drink containers
Sweden	Detailed household waste segregation (9 streams), 2015 targets 20% reduction in food waste (from 2010)
Brussels	Targets of 5% reduction in waste for specific streams; 'bans' on junk mail, telephone directories etc.
Munich, Vienna	Ban on disposable drink containers at events
UK	eQuip leasing scheme
Belgium	Accredited re-use centres (Flanders)
Austria	RUSZ Vienna, ReUse by ReVital
UK	Love Food, Hate Waste
Denmark	Major food waste reduction programme (Stop Spild Af Mad)

In relation to drinks containers, countries that have introduced mandatory deposit refund systems (DRSs) on one-way beverage packaging are among the European countries with the highest recycling rates of aluminium beverage cans. In Estonia, for example, the recycling rate is 29% higher than in neighbouring Latvia. In Finland the return rate of drink containers increased by 15% between 2008 and 2009 in connection with the introduction of a mandatory DRS. In Germany, by introducing a mandatory deposit on one-way packaging, a return rate of 98% and high recycling rates were achieved. While it is accepted that there are infrastructural and other issues relating to such schemes, there is no doubt but that they increase recovery levels.

Several regions have very stringent and detailed waste segregation schemes that encourage householders and commercial outlets to separate out the different fractions. In Sweden, for example, separate household collection of the following fractions takes place: paper, newsprints, white and coloured glass, metal, plastic, biowaste, fraction to landfill.

In the reuse sphere, initiatives are in place in several countries. Austria and Belgium in particular have achieved significant success in this field using accreditation systems, quality labels and other stimuli. The social and employment benefits of reuse are also substantial and need to be developed further.

With regard to food, there are, again, many schemes to reduce waste at all points in the product chain. In the UK, the *Love Food, Hate Waste* programme has achieved some success and a major scheme in Denmark, *Stop Spild Af Mad*, has initiated many actions to raise awareness in cooperation with public agencies and food producers.

Research

Many major research programmes are supporting resource efficiency in several sectors in other regions. Some of these are listed below.

Country	Initiatives
Austria	Building of Tomorrow; Building of Tomorrow Plus; Factory of Tomorrow; Intelligent Production
Germany:	Future Building research scheme (Zukunft Bau); Material Efficiency and Resource Conservation (MaRess) scheme
Belgium	Program “Erable” (research programme on energy conservation and renewables) (Wallonia); Input/Output model (MFA research in Flanders)
Netherlands	Resource Productivity research (e.g. CE Delft)
Sweden	Towards Sustainable Waste Management (TOSUWAMA)

Again, in many cases the focus on resource efficiency and the scale of the research is impressive and something to which Ireland should aspire. In Austria, one of the programmes, The *Intelligent Production Programme*, had a 2nd call for research in 2012 covering topics in relation to materials research and the control of raw materials and resources in globally competitive markets and the budget for this call alone was €22.5 million.

In Germany the *MaRess* programme is a large-scale research project involving 31 project partners from various scientific institutions, businesses and civil organisations. *The Zukunft Bau – Future Construction* initiative aims to promote sustainable building by carrying out research for the construction industry to overcome any hindrances to improving the efficiency of buildings.

Program ERable (in Wallonia, Belgium) is a funding research programme from 2011 in the area of energy efficiency and renewables, examining both technical and non-technical solutions. In Flanders, The *Environmental Input/Output (I/O) Model* inventories all relevant economic and environmental data with regard to production and consumption and is an extremely useful data resource to achieve resource efficiency in the region.

In the Netherlands CE Delft has done research to inform the Dutch government policy in relation to all sectors of resource use. *Towards Sustainable Waste Management (TOSUWAMA)* is a major research programme funded by the Swedish Environmental Protection Agency running from 2006 to 2012.

Green Public Procurement

Again, there are many good examples of green public procurement from around the world and particularly in Europe.

Country	Initiatives
Austria	Lower Austria – all new public buildings must be constructed to passive house standard since 2008
Sweden	One stop shop agency providing product criteria, training, advice etc.
Netherlands	Approaching 100% green public procurement in some sectors including social elements, criteria for 45 product groups
Norway	All government agencies must have an EMS in place, institutions with significant impact must have ISO 14001 or EMAS

At the local level, the province of Lower Austria (in Austria) has made it compulsory since 2008 to construct all new public buildings in the region to the passive house standard, providing leadership and good examples of new environmental technologies, which gives confidence to the market.

At national level, the Swedish Environmental Management Council is a one-stop shop in Sweden for all matters relating to green public procurement providing life-cycle based evaluation tools for several products; a chemicals policy outlines certain chemicals and substances, which should not be present in any procured products; online courses are available instructing users how to assess life-cycle costs of items and assess green criteria; comprehensive criteria documents have been set up for many product/service categories.

In the Netherlands, environmental criteria have been set for a product list of 45 product groups. The Government set stringent targets for different public sectors. The Monitor CSR shows how well these have been met. This states that by 2010 the following impressive results have been achieved:

- In 2010, the central government achieved 99.8% sustainable procurement - very close to the 100% target of 2015.
- Provinces (96%) and water boards (85%) achieved their 50% target easily.
- Municipalities have achieved 87-90% sustainable procurement, easily reaching the target of 75%.
- Universities (80%), schools (95%) and vocational schools (75%) have already achieved their 2012 target.

In Norway, Government institutions with a significant impact on the environment must implement a third-party certified environmental management system (such as ISO 14001 or EMAS) for all or part of their activities. All Government agencies must have some sort of environmental management system in place.

Life Cycling Thinking

One of the main tools for Green Procurement and more resource efficient products is the use of life cycle thinking: taking into account the environmental impact of products at all stages of their life cycle and in all regions (not just the region of consumption). Many instruments have been developed in different regions to assist purchasers and consumers in assessing these impacts as seen as follows:

Country	Initiatives
Austria	Eco-Design PILOT - Online eco-design tool with check-list for all life stages of products
Belgium	EcoDesign Link (OVAM initiative): Eco-design tools, Ecolizer 2.0 and SIS toolkit; Design to prevent waste research projects; EcoDesign awards scheme; Household Appliances – energy use and CO_2 calculator tools
Germany	WECOBIS: Web-based information on environmental impacts of construction materials, products and design for full life cycle improvements in this sector
Belgium, Netherlands	Chain Management Initiatives
Nordic Countries	Nordic Eco-Label: Ecolabelling system for consumers in Iceland, Norway, Sweden, Denmark and Finland
Germany	Der Blaue Engel: Long-standing eco-labelling scheme, very useful for green procurement
Basque Country and Wales	Eco-design centres
UK	Designing out waste – advice and guidance on eco-design (WRAP); Product optimisation - tools for retailers and buyers, on optimum life of products (WRAP)

Many of these are online tools that can easily be used to calculate environmental impacts and benchmark different products. Some are supports for eco-design that can be employed in the design stages of new products. Some relate to eco-labels such as the Nordic or Blue Angel, which can assist purchasers to make informed decisions. Some are sector specific, such as the *WECOBIS* database in Germany which covers products relating to construction. Eco-design centres in Wales and the Basque Country support improvements at the design stage of products.

In Belgium and Netherlands a product chain management approach is taken, whereby those involved in the different stages of a product life cycle (extraction, production, distribution, consumption, recovery and transport) come together to tackle resource efficiency all across the product chain. In the Netherlands companies who want to supply their products to public bodies are encouraged to apply to develop a chain initiative.

Awareness Raising

Awareness raising is a key inherent component in any resource efficiency programme. Most good programmes, such as those outlined earlier for resource efficient production, green public procurement, life-cycle thinking and the recycling economy will have inbuilt information dissemination elements.

There are many examples of how high levels of awareness can be achieved in different programmes in other regions. Awareness raising techniques and tools vary widely depending on the message being delivered, the focus of the initiative, and the target group in question. For example, the method of delivering some specific technical information to a subsection of a particular industrial sector will differ greatly from that concerning a general public environmental message to householders.

Some awareness raising initiatives abroad are outlined in this Table.

Country	Focus and Initiatives
Sweden, Netherlands etc.	**GPP** – targeted to public bodies, procurement personnel, training etc.
France	**Household behaviour** – major public awareness raising by media programmes etc.
Austria	**Resource Efficiency Production** – support agencies and networks: Styria Eco Technology Network
Belgium	**Recycling Economy** – Extensive reuse networks, certification systems, shopping outlets etc.
Denmark	**Recycling Economy** – food waste prevention logo on food items
Nordic Countries	**GPP and Recycling economy** – Nordic Swan
Austria	**Household behaviour (procurement)** - Sustainable weeks
Belgium	**BCR Waste Management Plan**: various initiatives for junk mail, plastic bags, discarded 'gadgets', home composting, office printing
Japan	**Household behaviour (procurement)** - Eco life promotion
Austria, Basque Country, Canada, EU (EWWR)	**Various foci** - one week dedicated to the environment, new initiatives and better behaviour

Some of the programmes listed in the Table are already described earlier (e.g. in relation to GPP, the Recycling Economy etc.) and it is clear that for any initiative to be successful it must have a high outreach level and good communication elements.

In Brussels, for example, to target the different objectives of their waste management plan, campaigns were run to raise awareness about ‘anti junk mail’ stickers, taxes on plastic bags, awareness campaigns to reduce the number of discarded ‘gadgets’, composting networks for garden waste and office waste campaigns such as ‘to print or not to print’, etc.

One-week campaigns are common in different countries, whereby awareness is raised by a variety of means on several focal areas, for example in Austria (retail), Basque Country (industry), European Week of Waste Reduction (many sectors of society), Canada (schools, public bodies, and SMEs).

For businesses, networking is a very effective means of innovation diffusion and in Austria the Styria Eco Technology Network is a good example of how this can work.

In the Gifu region of Japan, a points based system is in place in the retail sector whereby participants are rewarded for environmentally friendly behaviour (e.g. reusing bags etc.) and can collect points to trade in for eco-friendly products.

In France there are many examples of awareness raising, often at the regional level, to promote more sustainable consumption. One, in the Deux-Sèvres region involved a wide range of activities and achieved a reduction in 10% of waste per person between 2004 and 2008.

9. Roadmap for Resource Efficiency for Ireland

As shown earlier, there are several active and well functioning resource efficiency initiatives in Ireland. However, there are some areas where more can be achieved – as exemplified by the excellent and extensive activities being carried out other regions, also seen earlier.

Ireland also needs to intensify the current programmes in order to make the significant economic savings that can be achieved through resource efficiency – savings that the country urgently needs. A moderate target for Resource Efficiency could be set at 25% by 2020, which would require a modest annual material consumption reduction of between 0.2% and 1.9%.

Such gains would achieve savings in the region of:

Further strengthening of programmes and initiatives is also necessary to secure Ireland's clean green image abroad and to meet current and potential 2020 European Commission targets on Resource Efficiency. The following actions are recommended to help meet such targets and savings.

These are summarised in the two page Roadmap Summary Chart at the front of this document. Timescales, responsibilities, potential return and potential cost are allocated for each recommendation.

NB: It should be noted that while the responsibilities to initiate the recommendations are mainly allocated to public bodies, the 'actioners' (those who will actually attain such efficiency on the ground in their everyday lives and work) are also key players, in both the public and private sectors.

For example, it is not possible for public agencies to achieve efficiencies in the business sector without real and substantial 'buy-in' and actual implementation of initiatives by companies. This will also require key actions by business bodies and support groups, and other actors such as consultants, researchers etc.

Likewise in the domestic sector – it is very difficult to 'force' householders to reduce needless consumption and waste against their will.

Engagement will be required at individual person, household, community, individual business and business sector levels, as well as across the public sector.

All those involved in consuming raw materials and vital resources will have to be involved for the success of any national plan.

National Resource Efficiency Plan

It is vital that Ireland seeks to improve Resource Efficiency and Resource Productivity, for two very important reasons:

1. Very large savings can be achieved (greater earnings per unit material used), with potential for economic benefits and job creation.
2. It is consistent with current Government Policy and programmes to promote a 'Green Economy'. It is difficult to sell the concept of being a Green producer, when a major indicator (resource efficiency) puts the country near the bottom of the league.

The current scale of potential improvements and the levels of unnecessary and costly consumption have not yet been fully grasped in Ireland. The huge potential for economic savings, especially in our current economic difficulties, means that resource efficiency needs to be greatly prioritised and given appropriate significance in Ireland.

Resource efficiency must become a national priority from the highest levels of Government down to the individual consumer, with a multi-faceted, high-impact, integrated and well-resourced programme of action.
In order to achieve this, the following are recommended:

1. As a starting point, full Government backing for a multi-departmental National Resource Efficiency Plan, led by a Cabinet Committee chaired by an Taoiseach & supported by a Senior Officials Group (as in the Cabinet Committee on Climate Change & the Green Economy).

2. The plan should be given a high profile and should be led by a Minister, with a multi-annual plan, annual reports, specific targets etc. Consideration should be given to setting up the position of Minister of State for Resource Management, with responsibility for the national plan recommended herein and related environmental, energy and water issues. This position would greatly raise the profile of the issue of Resource Management and would enhance the possibility of an integrated approach across all relevant platforms, delivering the potentially significant savings for Ireland outlined in this report.

3. On the ground, a new body, The Resource Efficiency Team (RET), comprising dedicated staff seconded from Government Departments and relevant bodies such as EPA, SEAI, Enterprise Ireland etc. should be set up. This will coordinate the widespread activities with an adequate and substantial budget and staff allocation, leading to integrated and real cross-departmental action.

4. The many programmes and initiatives in place need to be fully coordinated into one overall programme and integrated so that they support and give added value to each other. These would then be seen as component elements of one focused plan, rather than as a set of individual actions, being implemented by different Government Departments and agencies.

Apart from formal partnerships (between, for example EPA and SEAI), there needs to be greater coordination of 'on the ground' relationships. For example, each agency should inform the others of what companies they are working with, and on what projects, etc. A common database of such information should also be produced.
It is recommended that:

5. A common database of Resource Efficiency initiatives should be produced, maintained, and available to all pertinent agencies.

Ireland has many specific environmental, economic and other targets, but it has no targets for resource efficiency, as yet. For example, Ireland has a specific energy efficiency target of 20% improvement in energy efficiency across the whole economy by 2020. However, Ireland (like most EU countries, except Austria and Germany for example) does not yet have resource efficiency targets. This should be rectified.

The European Commission recognises the need for resource efficiency targets. Its *Communication Roadmap to a Resource Efficient Europe* (COM (2011) 571 states:

By 2020: "Ambitious resource efficiency targets and robust, timely indicators will guide public and private decision-makers in the transformation of the economy towards greater resource efficiency." (p. 21) and "Reach broad agreement with these stakeholders on how to measure progress and to set the targets needed to meet the challenge (by 2013)." (p. 21).

The necessity for resource efficiency targets for Ireland is also stated in the 2012 Government document: *Our Sustainable Future – A Framework for Sustainable Development for Ireland*. (p. 38).

For modest GDP growth, a decrease in material consumption of no more than 2% per annum would achieve a 20% - 25% improvement in Resource Efficiency by 2020. This is somewhat below the recommended 'ambitious' target of 30% reduction in resource efficiency, but better than the 'moderate' target described in the Bio Intelligence Service study referred to above. It is also exactly half the targets of countries such as Austria and Germany. Considering Ireland's current economic situation, it is a reasonably ambitious target, with great financial benefits.

The setting of an actual target should be an early goal for the Resource Efficiency Team.

6. The Resource Efficiency Team should facilitate the necessary calculations to determine a suitable target for reduction in material consumption for Ireland. It is recommended that this target be 2% reduction per annum, or 25% improvement in resource efficiency by 2020, in the first instance.

In Ireland, the Total Primary Energy Requirement (TPER) was 16.5 Mtoe in 2008 and 14.8 Mtoe in 2010. This results in approximately €6 billion per annum spent on imported energy (2007). This compares to estimates for material input spending of approximately €40 billion to €50 billion per annum

Thus, it is estimated that Ireland is spending annually between 6 and 8 times as much on materials as it is on energy. However, the funding for energy efficiency seems to be far in excess of that currently spent on resource efficiency.

This anomaly should be rectified, and to do so, the following are recommended:

7. A minimum €70 million resource efficiency fund (€35 million seed from Government) to ensure major financial savings and job creation in relation to materials and water.

8. A funding increase of the grant-aid, technical assistance and support provided in current resource efficiency programmes in relation to materials and water to €30 - €60 million per annum.

While it is difficult to justify Government spending in the current economic climate, the potential financial benefits from resource efficiency are such that investment is well merited. The added benefits of jobs and potential growth make such outlay not only justifiable but also essential.

Resource Efficient Production

As has been outlined, Ireland has a number of very good business support programmes for resource efficiency. It is essential that these programmes be cemented, enhanced, and coordinated – so that maximum synergy can be achieved. This is recognised by the Government's 2012 document: *A Resource Opportunity: Waste Management Policy in Ireland*, which states:

"The policy notes the successes of the National Waste Prevention Programme, which "is seen as an example of best practice in Europe." With regard to prevention, the policy makes the following worthwhile recommendations:

"The next phase of NWPP should focus on resource efficiency, prevention and reuse and the development of coordinated approaches with other state agencies."

It is also essential that these programmes are provided with the resources required to meet the EU targets for Efficient Production laid out in the Commission 2011 Roadmap on Resource Efficiency as follows: "By 2020, market and policy incentives that reward business investments in efficiency are in place. These incentives have stimulated new innovations in resource efficient production methods that are widely used. All companies, and their investors, can measure and benchmark their lifecycle resource efficiency. Economic growth and wellbeing is decoupled from resource inputs and come primarily from increases in the value of products and associated services."

It may not be a case of investing additional funding, but of using current funding differently (i.e. move funding from elsewhere, where it is currently not producing such a return on investment). In any event, an increase in the allocation of funding to resource efficiency measures is recommended.

While the recommendations may seem to involve a considerable investment, it is, in fact, small compared to the potential savings. The Government should not necessarily spend any extra money in pursuit of this objective, but should seek efficiencies from synergy, and diversion of funds from other areas. It is not expected that these funds should come from any one individual Department.

The following measures are recommended regarding grant aid and soft loans in Ireland:

9. A significant increase in funding for grant-aid schemes supporting resource efficiency for materials and water in Ireland (e.g. Green Enterprise, EI supports etc.) – in accordance with the extra funding outlined in Recommendation 8.

10. The mandating and facilitation of soft loans to business and organisations for resource efficiency projects – as described in the resource efficiency fund allocation outlined in Recommendation 7.

One of the main areas where Ireland defaults is in the tracking of important data. Most other European countries recognise that national Material Flow Accounts (MFA) are as essential to the process of measuring Resource Efficiency, as monetary accounts are to tracking economic performance.

Apart from the production of National MFA accounts, it is recommended that benchmarking be given a greater priority in reporting mechanisms. One of the most successful Resource Efficiency programmes in Europe is the EPA's Green Hospitality Programme. One of the main tools used to bring about this transformation of a previously uninterested sector is benchmarking. Such data needs to be replicated for other prioritised sectors.

It is also essential that training on resource efficiency be provided to business, consultants (not just environmental consultants, but financial, legal, State Agency advisory consultants, etc. also). It is imperative that the import of Resource Efficiency be understood in terms of:

- Technical Aspects
- Economic Aspects
- National Strategic Importance

The following measures are recommended to improve resource efficient production in Ireland:

11. An annual update of accurate GDP/DMC data for benchmarking and progress analysis

12. The preparation of timely and accurate annual material flow accounts for Ireland.
The production of national sectoral benchmarks for significant economic and environmental sectors.

14. The introduction of nominally cost-neutral 'Train the Trainers' programmes, with a view to training businesses in resource efficiency on a wide scale.

Ireland's economy is particularly dependent on a number of sectors. It is also dependent on differing scales of enterprise. The Business in Ireland 2010 study found that SMEs represented 99.8 per cent of enterprises, and accounted for 46.8 per cent of gross value added - a key measure of business income. Resource efficiency initiatives should focus on the sectoral approach, and also provide assistance to both larger companies and to SMEs.

One sector, which is of particular importance to Ireland's economy, and which is already receiving particular attention, is the **Agri-Food Sector**. This sector is discussed separately.

It is vital that other important sectors are similarly approached. Such sectors might include: **construction, ICT, specific manufacturing sectors, specific service sectors, SME clusters, etc.** using co-operative approaches between the companies in the sectors and the umbrella bodies in place.

In terms of smaller businesses, some technical assistance (such as the €concertive programme) should be made available. In effect a light version of a Resource Efficiency Assessment (REA) should be implemented. This can take the form of simple checklists, Best Practice Guidance, or other local interventions.

In 2012 the Government recommended a new system of enterprise support in local authorities through the establishment of Local Enterprise Offices – or LEOs – in each authority to provide a strong platform for the local authority economic role.

Many local authorities are already assisting local enterprises to improve their resource efficiency through the Local Authority Prevention Network programme (LAPN). These local authorities have trained personnel in place (trained in resource efficiency).

The personnel active in this field, would be greatly assisted by the proposed production of guidance documents and training (see 'Train-the-Trainers', above), and could prove a perfect medium for delivery of REA light activities.

In a major 2011 world study on resources by McKinsey, 130 potential resource productivity measures were listed. Of the top 15 identified, some may be priorities for Ireland including: Building energy efficiency; Increasing yields on farms; Reducing food waste; Reducing municipal water leakage; Urban densification (reducing transport); Increasing transport fuel efficiency; More electric and hybrid vehicles; Shifting from road freight; Improving power plant efficiency.

Any analysis aimed at determining the most effective sectors to include in a national resource efficiency programme should be undertaken using the Pareto principle (the so-called 80:20 rule). Prioritisation can be made on the basis of the largest impact – either in terms of DMC (i.e. tonnes basis) or on an equivalent economic basis.

The following measures are recommended to improve resource efficient production in Ireland:

15. The performance of a Pareto analysis to determine those sectors with the greatest potential to increase resource efficiency – special consideration be given to Ireland's buildings and the construction sector.

16. The allocation of dedicated staff in local authorities to resource efficiency and the provision of training to them, with a view to diffusion in local areas.

17. The production and wide dissemination of sectoral guidance and checklists for prioritised sectors.

18. The facilitation of local authorities to undertake 'light' Resource Efficiency Assessments for local SMEs.

The EPA's Green Business programme already offers technical assistance to business, and has the aim of being a One-Stop-Shop (a single source which can provide information to all companies and organisations on all available Resource Efficiency business support scheme). It is recommended that this ambition be examined, and perhaps enhanced – in terms of any national synergy developments/policies.

19. The provision of a 'One-Stop Shop' source of information on all available Resource Efficiency business support schemes.

Recycling Economy

Since improving resource efficiency is a function of Domestic Material Consumption (DMC), it is clear that measures aimed at reducing material consumption will have a positive impact on resource efficiency. Two important such measures are reuse and recycling (even though these rank below prevention on the hierarchy).

To increase the levels of reuse and recycling, it will be necessary to implement a number of measures, fiscal, legislative, infrastructural, and educational.

The importance of reuse and recycling and the closing of material loops is recognised in countries such as Austria, which seek an increase in material efficiency and the expansion of the use of secondary raw materials and the extensive closure of recycling loops.

Supports must be put in place to reduce the level of unnecessary discarding of products and to extend the 'use' element of their life cycle. Price supports (though tax exemptions for example) for reused products should be considered, along with higher levels of training for upcycling, the use of certification schemes (as seen previously in other countries) etc. In the USA there are also tax benefits for those donating food and other items to charity – this is a major incentive for producers and retail outlets to donate food to foodbanks, for example, and should be considered here.

The implementation of a Good Samaritan Law, such as is in place in the USA and Italy could greatly support the voluntary provision and distribution of food to foodbanks etc. from retail outlets, without fear of litigation – thus decreasing food waste from this sector providing indemnity in a similar way to 'Good Samaritans' in emergencies under the *Civil Law (Miscellaneous Provisions) Act 2011*. This would also prevent fear of litigation with regard to reused electrical products etc.

Such measures will also help Ireland meet the specific targets and milestones laid out in the Commission 2011 Roadmap on Resource Efficiency.

The financial recommendations below also reflect the milestones in the EU Communication with regard to pricing and taxation: "By 2020 a major shift from taxation of labour towards environmental taxation, including through regular adjustments in real rates, will lead to a substantial increase in the share of environmental taxes in public revenues, in line with the best practice of Member States."

Some measures to improve the recycling economy are recommended as follows:

20. The introduction of proper pricing incentives to recycling – PRIs, deposit schemes, real pay-by-use waste disposal.

21. The internalisation of external costs for specific streams, such as single-use beverage cups.

22. The provision of supports for large-scale anaerobic digestion and composting, with the removal of current planning barriers etc.

23. The development of further and better segregation for recyclates, food etc.

24. The implementation of supports for reuse – price supports, tax exemptions, training, awareness raising, certification schemes, social employment schemes, the Good Samaritan Law.

Research

An understanding of the diffusion of innovations dictates that research programmes should not be top-down, but that a chain-linked model, using feedback loops is required. This takes into account both the needs and experiences of business. Further, innovations diffuse via networks – so that clusters of businesses (for example, in a sectoral approach) can learn from each other.

It is also essential that research orientation be focused on those areas likely to improve Resource Efficiency. There should also be a greater focus on supporting green procurement, eco-design, life cycle approaches, reuse systems, bring back schemes etc.

To this end, representatives of the various research-funding agencies should have close ties with those tasked with coordinating Resource Efficiency programmes.

As an overall observation, successful R&D (from invention to widespread diffusion) takes time. Thus, research should employ open call systems with 3 – 5 year budgets.

In addition to resource efficiency initiatives aimed at business, it is essential to ensure that consumer expectations do not drive the economy into a spiral of decreased resource efficiency (as measured by increased domestic consumption per capita). Thus, research is also required on themes, such as behavioural change in society and households.

Finally, an important line of applied research is in the development of simple and user-friendly tools to assist business and citizens make sustainable choices, and to assist with the promulgation of resource efficiency advice.

It is also the case that measurement of important parameters (e.g. water use in business, food waste in the home, and so on) is virtually non-existent at the moment. An essential first step to any improvement process is the gathering of baseline data. Thus, there is a need for research and development in the use of new media, Apps, remote monitoring, smart phones etc.

The following are recommended with regard to improved research for resource efficiency in Ireland:

25. Representative(s) of research-funding agencies to sit on the Resource Efficiency Team

26. Research to be closely linked to business and resource efficiency needs (e.g. Intelligent Production Programme Austria). This means that the needs of business must be considered, and that feedback loops inform the research activities. This requires a chain-link approach to innovation (as opposed to a linear, or top-down model).

27. Research to have a greater focus on “applied research”, e.g. On Green Public Procurement Supports; On resource efficiency in different sectors (this should tie in with the sectoral prioritisation but see also ‘Pilot Schemes’ below); The research by Green Enterprise and SEAI to be further expanded.

28. Research to have a materials, full life cycle focus.

29. The research findings should have a wide level of transfer into common practice in companies. *(See also 'Pilot Schemes' in recommendation 33)*

30. The use of open call research systems, with 3-5 year budgets.

31. Focused research into behavioural change in society and households in an Irish context for resource efficiency.

32. The development of tools for resource efficiency incorporating new media, new technologies, Apps, remote monitoring, smart phones etc.

It is understood in innovation diffusion circles, that user uncertainty decreases when pilot demonstrations in actual industrial sites are used. The adopter uncertainty curve shows that academic research is insufficient to promote a widespread adoption of an innovation. Uncertainty is high while at the academic research stage, but decreases rapidly with the introduction of demonstrations and pilot trials.

Thus the following are recommended to improve resource efficiency research in Ireland:

33. The following resource efficiency Research Programme(s) & supports should be implemented:

- In conjunction with sectoral representatives, specific applied research areas should initially be identified.
- Results (i.e. new technology) should be piloted in selected volunteer companies. This innovative pilot work would be strongly grant-aided.
- The piloting results should be used as feedback to the researchers for improvement.
- The pilot companies agree to be demonstration sites to allow diffusion of the technology to other users. (As an indication of this type of potential applied research, consider, for example, the development of innovative heat recovery systems for small-scale refrigeration plant).

Food

As a consequence of its importance to the national economy, and in keeping with the sectoral approach outlined previously, the Food Sector has been given special prominence herein.

The Agri-Food Sector is of considerable importance to Ireland, with over 150,000 jobs directly in place due to this sector comprising about 7.7% of the current workforce in Ireland. 85% of the products are exported, to a value of about €8.85 billion in the economy. The total value of the agri-foods sector to the Irish economy is valued at approximately €24 billion.

However, this great economic value could be much higher if food waste was reduced, and resource efficiency in the sector improved. Food waste is currently at unacceptable levels, and is costing economies, businesses and the general public large amounts of money.

Current food waste in the EU is estimated in EU27 at 89 million tonnes per annum (i.e. 179 kg per capita) with a projection for 2020 (if no action is taken) of 126 million tonnes (i.e. a 40% increase). To promote the idea of using food sustainably and to reduce waste amounts, MEPs called for 2014 to be designated as "European year against food waste".

In Ireland, food waste has also become a concern in recent years. It is estimated that over 1 million tonnes of food is wasted in Ireland annually. Typically, food waste is costed at between €2,000 and €3,000 per tonne making the total value of food waste in Ireland = €2 - €3 billion per annum.

This matter has been receiving considerable attention in Ireland through Stop Food Waste and other programmes. Many of the resource efficiency initiatives aimed at the business sector in general are also applicable to the Food Sector. However, there are also separate programmes aimed specifically at the food sector (e.g. Origin Green [Bord Bia], Green Seafood Programme [BIM]). In addition, many of the National Waste Prevention Programme resource efficiency programmes are closely allied to food initiatives. A good example of this is that a sizeable portion of Green Business assessments are reserved for Origin Green companies.

These initiatives must be consolidated and enhanced, not only to fall in line with the European Parliament's ambitions for food waste reduction, but also to be in keeping with any National Resource Efficiency programme. The following are recommended to improve waste prevention and resource efficiency in the agri-food sector:

The following are recommended to improve waste prevention and resource efficiency in the agri-food sector:

34. Set up a specific food oriented sub-group to the Resource Efficiency Team, consisting of representatives from EPA, SEAI, Bord Bia, BIM, etc.

35. Continue and expand close relationships between Bord Bia (Origin Green) and EPA (NWPP-Green Business) and SEAI.

36. Create similar close relationship between NWPP and BIM Green Seafood Processing initiative

37. Expand the StopFoodWaste programme to encompass businesses (commerce and manufacturing).

38. Establish sector specific benchmarks to enable improvement options to be identified (e.g. water use in dairy sector).

39. Establish unit operation specific benchmarks to enable improvement options to be identified (e.g. low flow/low temperature cleaning).

40. Sub-group to engage with suppliers of specific technologies (e.g. cleaning), in order to create a database of 'Best Practices'. This should form part of a web-based facility (perhaps as part of the 'One-Stop-Shop' suggested in Recommendation 19).

Green Public Procurement

Public bodies at all levels from Government down must do more with less, become more resource efficient and save money. A major method of doing this is to embed green public procurement in all public sector day-to-day activities. The examples of Netherlands, Sweden and other countries show that high levels of effective GPP can be implemented within the bounds of EU open market legislation and these should be followed.

In the Austrian Resource Efficiency Action Plan it is stated that the Government and public administration generally should act as a 'first mover' when it comes to resource efficiency/green procurement/green technologies and Ireland should follow suit.

The Green Tenders: An Action Plan on Green Public Procurement needs to be implemented as a matter of priority, with the allocation of sufficient dedicated staff and resources to ensure immediate application. Government and public agencies must lead by example and drive environmental technologies, techniques and products in many sectors. One leading sector would be that of construction whereby Ireland should follow the example of municipalities in Austria and build only almost zero energy, highly-efficient buildings, taking life-cycle approaches. This would also assist in meeting the targets in the construction sector as laid out in the 2011 Communication on Resource Efficiency.

The following are recommended to improve green public procurement in Ireland:

41. Real and immediate commitment and prioritisation of Green Public Procurement in every Government Department and public agency, from the top down, with dedicated high level personnel responsible for implementation.

42. High impact and wide-scale awareness raising programme on GPP at all sectors and levels of the public sector.

43. Cross-departmental approach to GPP with the allocation of duties to dedicated relevant personnel to ensure implementation.

44. Data gathering methodology and practice put into place immediately, whereby the full details of all public procurement are gathered centrally for analysis and so that progress can be measured.

45. The setting up of a 'one-stop-shop' for advice and information on Green Public Procurement with an allocated staff to answer queries, provide support, raise awareness, maintain website etc.

46. Initial setting up of simple criteria for different product groups which can then be communicated and implemented in the short-term, with a view to further development and more detailed and rigorous criteria to be prepared in due course.

47. Several training programmes at different levels for procurement and other relevant people so that a full understanding of GPP is developed and the criteria for product groups can be implemented.

48. GPP should eventually take into account the full environmental and social considerations of publicly acquired products and services across their whole life-cycles, whether the impacts are in Ireland or elsewhere.

Life Cycle Thinking

One of the areas where Ireland has fallen behind other leading countries in Europe and elsewhere is in life-cycle thinking approaches to processes, products and services. The concern in Ireland is still too heavily focused on the end-of-life of products and materials, rather than on all stages of the full life cycle - whether these impact on Ireland directly or on other countries. And the full effects of process changes are often not considered either.

The Dutch approach, for example, whereby environmental and social concern is fully considered in public procurement with regard to the full life-cycle of all materials and products imported into that country should be replicated in Ireland.

However, certain tools and instruments are necessary to make informed decisions with regard to life cycle thinking and these should be developed as a starting point. Examples of several of these in other countries are given previously and should be replicated here.

Traditionally, there is a tendency to think of Life-Cycle effects in terms of the so-called 'cradle-to-grave' approach – i.e. taking into consideration all possible effects from raw material extraction to end-of-life waste disposal.

However, when considering Resource Efficiency measures, the life-cycle must also take cognisance of the effects that any improvements have elsewhere. Processes do not exist in isolation. All processes are coupled with other processes. Thus, there are always life-cycle effects. When modifying a process, consideration must be given to alterations in associated processes.

The following are recommended:

49. The development of eco-design support tools for several product groups so that product developers and purchasing personnel can make informed decisions as to the best options with regard to materials and functionality across the full product life-cycle.

50. The promotion of current eco labels in place in Ireland and consideration of the development of others.

51. Full life-cycle cost pricing to be developed for products such as buildings, transport, electrical and water consuming goods and materials. This will assist purchasers not just to consider initial cost, but the full cost of the product over the full life-cycle, given that they will consume energy, water etc. Strong consideration should also be given to additional labelling, which would give customers not only the purchase cost, but also the total lifetime cost of potential purchases.

52. Development of chain management initiatives, such as those underway in Netherlands and Belgium, whereby different sectors of companies would work together to develop full-life cycle approaches to product development and utilisation.

Awareness Raising

For any resource efficiency programme or initiative to work, it is necessary to promote awareness and knowledge for real and lasting behavioural change.

All the categories of resource efficiency described in this section require elements of awareness-raising to achieve effective change. But the means of awareness raising and the channels and methods used will vary, depending on the message being delivered and the target group.

Since the economics of major media driven awareness raising programmes are prohibitive, it is recommended that current high-profile and widespread programmes in place, such as Tidy Towns, Stop Food Waste, Green Schools etc. be utilised to the full.

Rather than fund large-scale new programmes, current activities of the National Waste Prevention Programme, Sustainable Energy Authority of Ireland, Enterprise Ireland, An Taisce etc. should be intensified.

The overall programme (comprising many different more specific programmes) would be coordinated by the Resource Efficiency Team in conjunction with all the current agencies in place, the local authorities, NGOs and other bodies already involved in awareness-raising.

Special emphasis in awareness-raising should be put on achieving effective and informed behavioural change in business, public bodies, communities and households.

The following is recommended with regard to awareness-raising in Ireland:

53. A series of widespread and intensive awareness raising campaigns should be developed to support all the various initiatives and target groups described in earlier recommendations.

"We cannot solve our problems with the same thinking we used when we created them"

- Albert Einstein.

An Ghníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomh-nithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil, Pobal agus Rialtais Áitiúil.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreail;
- scardadh dramhuisce;
- dumpáil mara.

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil - aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí comhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOL

- Monatóireacht ar chaighdeán aeir agus caighdeáin aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntí a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdéan aeir agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Ghníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaimseartha, ar a bhfuil Príomhstiúrthóir agus ceithre Stiúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar imní iad agus le comhairle a thabhairt don Bhord.

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Climate - Water - Sustainability
Identifying pressures • Informing policy • Developing solutions

Roadmap for a National Resource Efficiency Plan for Ireland

Identifying Pressures:

At present, Ireland spends approximately €46 billion on raw materials per annum. Ireland also has one on Europe's highest ratios of Direct Material Consumption (DMC) to GDP. It is vital that Ireland seeks to improve Resource Efficiency and Resource Productivity, for two important reasons: 1) very large savings can be achieved with potential for economic benefits and job creation, and 2) it is consistent with current Government policy to promote a 'Green Economy'. If Ireland becomes even slightly more resource efficient, significant savings can be made for the country. Relatively small investments could achieve major financial improvements.

Informing Policy:

A range of resource efficiency related activities are taking place in Ireland, in a wide variety of sectors, by public sector and private groups. These are driven by several Government policies and programmes, as outlined in this report. In many cases, for relatively modest investments, they are achieving significant cost savings and economic benefits to society. However, Ireland can and should be doing more, not least to meet EU commitments and targets laid out in *The European Commission Communication Roadmap to a Resource Efficient Europe (COM (2011) 571).*

Developing solutions:

The main finding of this study is that Ireland currently needs a fully integrated and comprehensive National Resource Efficiency Plan with: Full Government commitment, from an Taoiseach down; A Minister's leadership; A dedicated Resource Efficiency Team; Sufficient resources to meet the recommended targets; Full implementation of the detailed activities advocated in this study. These recommendations actions include the following areas: Resource Efficient Production, Recycling Economy, Research, Green Public Procurement, Life Cycling Thinking, Awareness Raising.

Comhshaol, Pobal agus Rialtas Áitiúil
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