

APPENDICES



I Pilot project contextual assumptions

Introduction

The pilot project on negotiated energy agreements is now entering the main negotiation phase. The purpose of this phase is to take the results of the energy audits and to move from these to agreed notional sets of actions to be undertaken by participating firms in order to comply with the agreement.

It is necessary to establish a set of contextual assumptions to allow these negotiations to be as realistic as possible. These assumptions will create a credible environment of tax benefits from compliance in order to allow firms to calculate the incentive for participation and to evaluate what is acceptable in terms of agreement context. This cannot be done without a notional context of the cost, in tax terms, of non-participation in an agreement.

While it is important that the assumptions made are plausible, coherent and realistic, no attempt is made to adopt assumptions close to any likely future policy context in Ireland. SEI does not wish to involve itself, or this project, in broader debates about tax designs and levels and other associated policy issues at this time. The objective here is to test the negotiated agreement measure.

Thus the assumptions presented here are made without prejudice to, and do not imply acceptance on anyone's part of any element with regard to future climate change policy in Ireland.

Core Principles

Separate to the background assumptions to be made on taxation and other issues, there is a core set of principles for the agreements measure that should be kept in mind during the final phases of the project. These are the basic requirements of any design of negotiated agreements for it to be considered adequate and acceptable in policy terms, and will

remain central values of the project through the negotiation phase.

Beyond business as usual

The National Climate Change Strategy clearly states that any carbon tax rebates associated with negotiated agreements will only be available on the basis of firms moving significantly beyond business as usual in terms of energy efficiency performance.

Moving towards Best International Practice on an economic basis

Again taking the policy signal from the National Climate Change Strategy, the intent of an agreements measure is to facilitate an accelerated move toward Best International Practice in energy efficiency. The pace of this path will be guided by economic considerations.

Protecting competitiveness

Competitiveness has been a stated concern of the project from its inception, and protection of firms' competitiveness will remain an important component of the analysis.

Raising the strategic importance of energy efficiency

The long-term imperatives of climate change abatement and the required shift towards a carbon constrained economy dictate that energy efficiency become a strategic issue for all firms. The project's emphasis on energy management and systems as well as specific investment actions, aims to enhance the profile of energy efficiency and emissions abatement at senior level in all firms.

Credit for early action

Firms that have already taken action on energy efficiency have a reasonable entitlement to receive credit for this and to be judged on an equitable basis with those that have not yet done so. The action based design of the pilot agreements should ensure

that firms are compared equitably and participants will be assessed on the basis of the gap between their current practices and Best International Practice. Those that are closest to the top level will have the least asked of them in the project.

Pilot agreement design parameters

Basis of negotiated agreements

Binding action-based agreements, with outcomes of actions converted into an overall target for emissions reductions. Tax exemption for compliance.

Scope of agreements

All energy related techniques/technologies covered by the agreement type. All agreements to include action to ensure companies have best practice energy management systems/structures in place.

Time period for agreement

Assume 4 years, start 2004 to end 2007.

Reference year for energy and other related data:	Calendar 2001
Agreement signed:	May 2003
Agreement period:	January '04 to December '07
Interim reviews:	September 2004 September 2005 September 2006
Final review:	September 2007

Each September review monitors progress (through self reporting with spot checks) to determine compliance and hence continuation of the tax exemption. Notionally, the final review in September 2007 would prepare for a new agreement from 2008. Assume that firms have some leeway, to be assessed

by SEI, in terms of timetable slippage but that ultimately non-compliance, withdrawal or non-reporting would lead to liability for the tax exemption over the full agreement period.

Assumed taxation mechanism for compliance

The pilot project assumes that the mechanism for compliance with the notional agreements is a carbon tax, for which exemptions are given for agreement participants. This is in line with national policy, and indeed proposals for a carbon tax in Ireland are progressing, with an introduction date signalled as the end of 2004.

For the pilot project, a tax on all energy streams based on their carbon content will be assumed.

Based on comparison with a range of carbon tax mechanisms in other states, a carbon tax level of €17.50 per tonne of CO₂ will be assumed as the full level of tax payable by firms not participating in a negotiated agreement. This sets the notional tax at a comparable level to other states and also takes account of elasticity calculations of the tax level required to meet national abatement targets for the sector.

As an indication, our calculations suggest that a carbon tax of €17.50 per tonne of CO₂ would imply the following retail price increases:

Natural Gas	€0.0035 per kWh
Light Fuel Oil	€0.0048 per litre
Electricity	€0.0136 per kWh

In the pilot project, firms who reach a notional agreement will receive an 80% exemption from the carbon tax. The exemption will be available from the first calendar year of the agreement, i.e. 2004 in this case.

Energy from renewable sources would be exempt from carbon tax. CHP will benefit from the tax structure by default due to its higher carbon efficiencies.

CHP will be assessed as a potential action in firms where it is technically appropriate. For those firms with CHP already installed, the audits will be analysed to consider ways to ensure that the CHP is being operated to standards of good quality. To assess quality we propose to use the legal definition in Ireland of 70% overall operating efficiency (based on gross calorific value) and for those units not achieving this, we will apply the definition of high efficiency CHP as per the draft EU CHP Directive where CHP energy production should be providing primary energy savings of at least 5% compared with conventional production (less savings required for CHP from renewables or CHP with an installed capacity below 1 MWe).

For those firms operating good quality CHP, their higher carbon efficiencies will push potential actions out in payback terms, and so may result in those firms being asked to undertake fewer such actions. This is in keeping with the concept of rewarding those firms who have already undertaken energy efficiency investment. Again, the principle is to close the gap between current practice and Best International Practice, and for those who have already partially closed this gap through installation of CHP, less will be required in the agreement.

Agreement form

It is intended that agreements will contain a set of actions to be notionally undertaken by the firm over the period of the agreement. Energy management and basic systems and monitoring will be a minimum requirement in all agreements, as will a commitment to enhanced profile and strategic consideration of energy efficiency and emissions abatement.

Potential investments identified by the energy audits will be assessed in terms of their economic implications and potential impacts. The details of this evaluation will be the subject of the negotiations. The general form of the agreement will probably include the longest list of actions required by the entire group, from which individual firms will remove those

that do not pertain or which they have already undertaken. Agreements will be based on the actions identified, but CO₂ abatement impacts will also be assessed for information purposes.

Larger or more strategic investments in energy efficient technology identified through the audits might be incorporated in the agreements as special investigations to be carried out by the firms. Such investigations may be appropriate if potential projects have longer paybacks but very high potential energy gains, or for projects with process or other implications. The timetable and procedures for these special investigations will be part of the agreement. Review of these investigation reports, with a view to possible inclusion in the current or future agreements, will also be part of the agreed package.

II. Final agreements text

A Technology Agreement - June 2003

1. Introduction

This document contains text for a negotiated energy agreement following detailed discussions between Sustainable Energy Ireland and representatives for the 15 companies working with SEI on development of a technology agreement covering hot water and steam generation and distribution. The principal aims of the agreement are to:

Achieve substantial reductions in energy consumption and related greenhouse gas emissions within the organisations participating in the agreement, and in the technology areas covered by the agreement; while:

- Affording the opportunity for participating organisations to recover a substantial proportion of the carbon/energy tax for which they would otherwise be liable.
- This document contains those aspects of the agreement, which have been discussed and agreed in principle between SEI and the participating firms' group representatives.

The following points should be noted:

- The negotiations and agreements have been reached as part of SEI's pilot project on negotiated energy agreements. Whilst an aim of the project is to produce draft agreements to which all parties would be prepared to commit given the introduction of a taxation/agreements package similar to that assumed in the project, the outcome does not bind either party in any way.
- The context for the agreements has been a set of assumptions concerning a possible carbon/energy taxation and agreements package developed specifically for this pilot project. These assumptions in no way describe or refer to policy decisions to be taken ultimately by the Government. The final structure and parameters of a taxation and agreements package may alter the points agreed in this pilot, to the extent that they impact on the economic assessment of each action described herein.

- The actions discussed have arisen out of a set of energy audits conducted in each of the 15 participating organisations in the thermal agreement strand of the pilot project. The audits were conducted using a template designed to assess what actions would be needed in order to progress past 'business as usual' in the thermal energy field, and towards Best International Practice.

2. Definitions

The Agreement: refers to the Draft Negotiated Energy Agreement – Thermal Energy

Best International Practice (BIP): refers to the use of the best feasible (from a technical and economic point of view) energy technology and management practice resulting in optimum performance in relation to minimising energy consumption and related emissions.

Company/Organisation/Site: these words are used interchangeably in this version of the Agreement. They refer to the entities participating in the pilot project on thermal agreements, whether these are companies, other forms of organisational entity, or single sites within a larger organisation.

Renewable energy sources: renewable non-fossil energy sources (wind, solar, geothermal, wave, tidal, hydro-power, biomass, landfill gas, sewage treatment plant gas and biogas).

Biomass: biodegradable fraction of products, waste and residues from agricultural (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste.

3. Scope, target and principles of the Agreement

3.1 Basis of negotiated agreements

- The notional framework is that of binding action-based agreements, with firms committing to a set of:
 - Specific energy investment actions
 - Energy management improvement measures
 - Overall efficiency benchmarks
- The overall goal of these measures is to reduce the CO₂ emissions associated with energy use at the site. The notional framework sets a context of a carbon tax on all fossil fuel related energy streams, with an 80% rebate available to firms complying with this agreement. The details of the taxation measure and the rebate available are set out in Section 4.
- The agreements are taken to be of four years duration, commencing on January 1st 2005²⁵. Annual self-reporting, with spot checks, is taken as the notional compliance process. The penalty for non-compliance is taken to be full liability for the assumed carbon tax for the full duration of the agreement.

3.2 Scope of the Agreement

- a The Agreement covers all aspects of participating sites' thermal energy generation and distribution, including aspects of final demand that are common to organisations regardless of sector.
- b The Agreement does not in general cover end use plant and equipment, other than where this represents a common end use for thermal energy within sites. Production process equipment is not covered. Process emissions (emissions arising directly from specific production processes) are not included in this Agreement.
- c The main body of the Agreement including Annex A does not include CHP. CHP in the context

of the Agreement is addressed in Annex C to the Agreement.

3.3 Target participants

The Agreement is aimed at all organisations in the industrial (and possibly services) sector. Whilst in theory organisations of any size could participate as signatories, in practical terms (cost of administering the Agreement, etc) it is unlikely that very small organisations with correspondingly small annual energy usage will participate, unless its energy intensity is exceptionally large.

3.4 The notional nature of the Agreement

This agreement represents the outcome of the SEI pilot project on negotiated agreement, undertaken on the basis that participating firms are under no obligation to implement any of the measures contained herein. By signing the Agreement, firms acknowledge that the programme set out represents a rational and desirable energy programme, the implementation of which would bring the firm towards Best International Practice in energy efficiency, against the context of a set of assumptions and criteria which are notional in nature and which as yet remain to be finalised.

3.5 The contingent nature of the Agreement

The assumptions set out in Section 4 below, determine the notional cost of non-compliance to firms in the pilot project, and hence significantly influence the outcomes. All parties acknowledge that the contents of the Agreement are contingent on these assumptions and should not be interpreted as a likely or valid outcome from any future agreement measure based on different design parameters or contexts.

3.6 Principles underlying the Agreement

Beyond business as usual

The National Climate Change Strategy clearly states that any carbon tax rebates associated with negotiated agreements will only be available on the basis of firms moving significantly beyond business as usual in terms of energy efficiency performance.

Moving towards Best International Practice on an economic basis

Again taking the policy signal from the National Climate Change Strategy, the intent of an agreements measure is to facilitate an accelerated movement toward Best International Practice in energy efficiency. The pace of this movement will be guided by economic considerations.

Protecting competitiveness

Competitiveness has been a stated concern of the project from its inception, and protection of firms' competitiveness will remain an important component of the analysis.

Raising the strategic importance of energy efficiency

The long-term imperatives of climate change abatement and the required shift towards a carbon constrained economy dictate that energy efficiency become a strategic issue for all firms. The agreement's emphasis on energy management and systems as well as specific investment actions, aims to enhance the profile of energy efficiency and emissions abatement at senior level in all firms.

Credit for early action

Firms, which have already taken action on energy efficiency, have a reasonable entitlement to receive credit for this and to be judged on an equitable basis with those, which have not yet done so. The action-based design of this pilot agreement should ensure that firms are compared equitably and participants will be assessed on the basis of the gap between their current practices and Best International Practice.

Shared responsibility

The thrust of the technology agreement in particular

is to make negotiated agreements available to as many entities in the industrial sector (and possibly other sectors also) as possible. This spreads the responsibility for abatement of emissions as far as practicable, and also makes available to smaller organisations an instrument which will help them to reduce their energy consumption and related emissions, and provide them with the means to reduce their exposure to the energy/carbon tax.

4. Assumed taxation mechanism for compliance

- The pilot project assumes that the mechanism for compliance with the notional agreements is a carbon tax, for which rebates are given for agreement participants. This is in line with national policy, and indeed proposals for a carbon tax in Ireland are progressing, with an introduction date signalled as the end of 2004.
- For the pilot project, a tax on all energy streams based on their carbon content is assumed.
- Based on comparison with a range of carbon tax mechanisms in other states, a carbon tax level of €17.50 per tonne of CO₂ will be assumed as the full level of tax payable by firms not participating in a negotiated agreement. This sets the notional tax at a comparable level to other states and also takes account of elasticity calculations of the tax level required to meet national abatement targets for the sector.
- In the pilot project, entities which reach a notional agreement will receive an 80% exemption from the carbon tax. The rebate will be available from the first calendar year of the agreement, i.e. 2005 in this case. For simplicity, the pilot project assumes that (i) the rebate for participating firms will be delivered directly through a reduced demand for taxation payments on an ongoing basis; (ii) the full taxation level of €17.50 per tonne CO₂ applies for the duration of the Agreement
- Energy from renewable sources would be exempt from carbon tax.
- CHP is addressed in Annex C.

²⁵ In practice, no agreement would be expected to come into force until the introduction of a carbon/energy tax framework.

5 Required actions by signatories to the Agreement

5.1 Required actions

- Signatories to the Agreement will assess all of the actions listed in Annex A which forms an integral part of the Agreement, in relation to technical feasibility and to the economic criteria set out in Sections 5.2 and 5.3 respectively. The full assessment procedure is detailed in Section 5.3 below.
- All of those actions which meet the technical and economic criteria will be implemented within the life of the Agreement, and having regard to Section 5.4 (Phasing).
- Records will be kept of assessments carried out in respect of each action.
- Signatories will also measure and record overall efficiencies (generation and distribution efficiencies) of their plant, and will use this to benchmark their performance against Best International Practice (BIP) standards (as described in Annex B which forms an integral part of the Agreement). Where the site's efficiency levels are below the BIP benchmarks, management will endeavour to take further action aimed at achieving BIP to the extent that this is practicable.

5.2 Technical assessment criteria

The technical criteria to be applied in assessing each potential action for applicability are as follows:

- Is it technically feasible to implement the action on the plant and equipment installed on site? Assessment of technical feasibility includes:
 - a The extent to which the action is applicable given the nature of the site's equipment, and the pattern of hot water or steam demand;
 - b Feasibility to implement given any physical constraints arising from the

- a current installation;
- b The extent to which implementation will result in reductions in energy consumption or in energy related emissions.
- c The extent to which implementation will result in reductions in energy consumption or in energy related emissions.

- Can the action be implemented such that it does not infringe any Health and Safety or other statutory regulations?
- Can the action be implemented such that it does not impinge negatively on the functionality and/or life of existing plant and equipment?

If the answer to each of the above is in the affirmative, then the action will be implemented provided it meets the economic criteria set out in Section 5.3 below.

5.3 Economic assessment criteria

CHP is excluded from the economic assessment criteria below, as it is addressed separately in Annex C to the Agreement.

Actions assessed as technically feasible will be implemented provided they meet each of the economic criteria below:

- a For each individual action: The simple payback period shall be 5 years or less, where simple payback is calculated on the basis of:
 - i Total cost of implementation (investment cost; installation/ implementation costs; additional operating costs, if any);
 - ii Total reductions in operating costs arising from implementation.
- b For the overall package of actions:
 - i The overall simple payback, based on summing the costs and benefits of all individual actions passing the technical and 'individual action' payback criteria, shall be 3.5 years;
 - ii The ratio of total investment required, divided by the period of the Agreement (4 years), and expressed as a percentage of the site's total annual thermal energy costs (in 2001), shall be 20% or less.

Where criteria b.i and/or b.ii are not met, then actions having the lowest ratio of estimated CO₂ savings (tonnes) to investment cost (€) will be progressively removed from the package of actions until both of these criteria have been met.

5.4 Phasing of actions

Phasing of implementation will be planned having regard to the following principles:

- Early action to minimise emissions;
- Protection of competitiveness.

Each site will draw up an implementation plan²⁶ covering the whole package of actions to be implemented, and the full period of the Agreement, based on the following:

- i Wherever feasible, those measures having maximum impact in terms of reductions in CO₂ will be implemented first.
- ii Actions will be phased such that necessary investments are more or less evenly spread over each of the four years of the Agreement²⁷.

6 Compliance and record keeping

- a Organisations participating in the Agreement will be required to keep adequate records to demonstrate their full compliance with the terms of the Agreement.
- b It is expected that the primary means of reporting compliance will be by means of self-reporting, by means of a pre-printed form.
- c Whilst participating organisations are expected to implement all of the actions which are specified in Annex A and which are assessed as applicable to them, they are also expected to make regular measurements of overall generation and distribution efficiencies, and to assess these against equivalent Best International Practice benchmarks (see Annex B). The first and primary mechanism for reporting and checking

compliance will be the attainment of the appropriate BIP efficiency levels as described in Annex B. However, where doubts arise as to the efficiency levels attained, the participating organisation may also be required to produce evidence that all actions specified in Annexes A and B have been assessed and, where appropriate, implemented in accordance with the organisation's implementation plan.

7 End point of the pilot agreement

The end point of this agreement pilot is the signature of each organisation's Chief Executive Officer (or equivalent) on a note of principle stating that:

- a The organisation accepts in principle the terms of this agreement.
- b The organisation would in principle, but without prejudice to its future decisions, be willing to sign up to an agreement of this type and content, on the basis that the taxation mechanism and levels as set out in the Agreement were to be implemented.
- c The agreement content as set out in Annex A is accepted in principle as a rational and desirable action plan for moving towards Best International Practice on energy efficiency.

²⁶ In the full Agreement, SEI would provide a simple/standard template to facilitate firms in the development of their implementation plan.

²⁷ In the full Agreement, SEI would provide a specification and samples of a simple but comprehensive set of expected records and evidence pack.

II. Final agreements text

A Technology Agreement - Annex A: Action Schedule

1. Energy management

Introduction – energy management in negotiated agreements

Energy management in companies participating in a negotiated energy agreement is centrally important for at least four reasons:

- To ensure that the participating companies maintain their technologies and practices as near to International Best Practice as is feasible;
- To ensure that the companies seek to identify opportunities on an ongoing basis for reductions in energy consumption and related emissions;
- To ensure that the companies' management and staff – and in particular the senior management team – are committed to ongoing management of energy and emissions;
- To ensure that the companies maintain adequate records of actions taken and their impacts on energy and emissions, such that they can demonstrate their compliance with the terms of the agreement.

The management actions outlined below are organised under the headings of:

- Energy policy
- Organising and resourcing energy management
- Investment in reducing energy consumption and related emissions;
- Information systems (which must be appropriate to the size of the company and adequate to support management actions to identify opportunities, monitor progress and report to management and staff)
- Motivation and marketing in relation to energy management

It is expected that a programme to ensure that firms' energy management meets the requirements set out below will be commenced in the first year of the Agreement, and be substantially completed by the end of year two.

1.1 Energy policy

- A written energy policy will be agreed at the most senior level in the company, covering investment in energy-consuming plant and equipment, continuous improvement of energy performance, and the organisation and resourcing of energy management.
- Overall responsibility for the energy brief will be assigned to one manager on the senior management team within the plant.
- Progress in improving energy performance will be reviewed by senior management on a monthly basis, as a minimum, and this will be recorded – e.g. in the minutes of the senior management meeting.

1.2 Organisation

- Operational responsibility for energy management on a plant-wide basis will be allocated to one manager. In most cases this will be a part time responsibility, and in smaller companies it would be appropriate that the senior manager appointed with overall responsibility for the energy brief (see Section 1.1b – Energy Policy – above) should also assume operational responsibility for energy management.
- Responsibility for proposing and implementing an ongoing plant-wide energy management programme will be formally allocated to one manager within the plant. In smaller companies, the energy manager may be the accountable senior manager (see Section 1.1 – Energy Policy – above); however, where appropriate, a separate energy manager will be appointed with day to day responsibility for implementation of plant-wide energy management and for reporting to the senior team.
- An operational programme aimed at implementing all aspects of the negotiated agreement, and for identifying further opportunities for improvement, will be put in place. The programme will include clear goals to be achieved.
- The company will incorporate all of the elements of metering/meter-reading, data

gathering/analysis, ongoing monitoring, reporting and target-setting referred to throughout this action list into a system of Monitoring and Targeting (M&T). The sophistication of the M&T systems will be designed so as to be appropriate to the company's energy consumption, energy intensity, and complexity of operations²⁸.

- A cross-functional energy team will be established in order to identify opportunities for improvements and for implementing programmes aimed at achieving reduction goals.

1.3 Investment

- All decisions on investment in equipment will take full life cycle costs into consideration²⁹.
- Appropriate energy efficient options will be specified at design stage for new and refurbishment projects, such that the plant operates as near as practicable to Best International Practice.

1.4 Information systems

- An appropriate level of metering will be put in place such that it enables monitoring and reporting on separable uses of thermal energy (e.g., energy consumption per unit for separate products or product lines; energy consumption in discrete areas of the plant; energy consumption of energy intensive plant and equipment). See also Section 1.6.1 below– Meter-reading and inspections.
- Data will be collected (manually or automatically as appropriate), collated and analysed, and presented in reports in order to enable monitoring of energy and emissions, and reporting to senior management and managers and staff across the plant.
- Reports will be issued regularly and used to stimulate further action and ongoing target setting (see 1.2d above).
- Energy/emissions performance will be benchmarked against Best International Practice. As a minimum requirement, the company will regularly measure and record overall generating and distribution efficiencies of the thermal energy

plant (see also Annex B – Benchmarking against Best International Practice).

1.5 Motivation and marketing

- Staff will be provided with energy awareness training.
- Energy/emissions performance will be communicated to all staff at regular intervals.

1.6 Meter-reading and Inspections

1.6.1 Metering

- If available, steam/hot water meters should be read at least weekly. Steam/hot water meters should be fitted if this meets the economic criteria within the Agreement (see Section 1.4 – Information Systems – above). Otherwise, steam production should be monitored weekly by:
 - Monitoring of fuel to the boiler
 - Monitoring of feedwater to the boiler.
 - Or if practical, monitoring of condensate from each production unit.
- Data from metering should be regularly analysed against known demand - e.g. production levels - and any anomalies should be followed up.
- Records should be kept of meter readings, and of any analyses and follow-up actions. The extent and frequency of the analyses will depend on the size of the company and the likely energy savings as a result of the monitoring process, but it is recommended that meter readings should be carried out at least monthly.

1.6.2 Maintenance/Inspections

- There should be at least annual steam/hot water raising plant and distribution system inspections. These should be recorded, as should any maintenance carried out as a result of these inspections. The detail on what should be inspected is given in the specific sections below.

²⁸ In assessing the level of sophistication appropriate to the company, recourse may be had to ETSU Good Practice Guides 31 (Computer-Aided Monitoring and Targeting for Industry) and 125 (Monitoring and Targeting in Small and Medium-Sized Companies), and ETSU Report 19 (A Review of the Monitoring and Targeting Programme in the UK Manufacturing Industry).

²⁹ That is, financial appraisal of investment proposals will take into consideration: initial investment cost; all future costs including operating energy, maintenance and repair costs; all savings including the savings in energy/carbon tax that would arise from an energy-efficient option; and the salvage value at the end of its economic life).

2. Steam and Hot Water Generation

In general where significant (greater than two years payback) actions are to be retrofitted to host boilers then the remaining life of the host boiler plant should be five years or more. Actions covered by this criteria would be the addition of control equipment, variable speed drives, flue dampers and economisers.

2.1 Boiler condition

- Boilers will be operated at optimum efficiency, with appropriate operational records being kept of boiler condition/performance.

2.2 Combustion Control

- Combustion efficiency will be determined by an appropriate means before and after re-adjustment of the air/fuel ratio during maintenance.
- In the first year of the Agreement, the potential for improved combustion control will be examined (including an assessment of the potential for oxygen trim control) for the boiler(s) in question, and suitable additional controls will be put in place where the examination suggests that this will lead to improvement.
- Adequate controls will be put in place to maintain combustion efficiency at optimum levels.

2.3 Boiler sequencing control

- The boiler and combustion equipment will be sequenced to ensure that the minimum number of boilers of an appropriate capacity is on-line to meet the expected demand.
- The use of boilers maintained on hot standby will be kept to a minimum.
- For multi-boiler installations, an appropriate boiler sequence control system will be installed.
- In the first year of the Agreement, the potential will be examined for reducing short-term load swings either by installing a steam accumulator or through appropriate demand management, and action will be taken where this meets the technical and economic criteria in this Agreement.
- Alternatives will be considered for the provision of

heat during periods of minimal demand, and the most economic alternative will be put in place where this meets the technical and economic criteria in this Agreement.

2.4 Blowdown/water treatment

- The company will monitor and control boiler TDS.
- The company will monitor and control water treatment through a regular testing and sampling regime.
- Blowdown heat loss will be minimised by installing automatic controls where appropriate on continuous blowdown, and by use of adequate procedures to manage bottom blowdown.
- Heat recovery on continuous blowdown systems will be installed where this meets the technical and economic criteria in this Agreement.

2.5 Variable Speed Drives on FD Fans

- Companies will install VSDs on Forced Draught fans, depending on suitability and load characteristics.

2.6 Flue dampers

- Companies will:
 - Install flue gas dampers on boilers, where not previously installed.
 - Carry out an annual inspection and assessment of the operation and performance of existing dampers and repair/replace if sub-optimal.

2.7 Boiler and Ancillary Equipment Insulation

- At the start of the agreement, and for the duration of the agreement, ensure that all insulation is to the appropriate (BS or equivalent) standard, including standards for the insulation product and the installation of insulation.
- For the duration of the agreement, ensure that all new/replacement insulation fitted is in accordance with the BS or equivalent standard as a minimum.
- Carry out a full annual inspection of insulation quality and installation, and repair and make good any defects as soon as practicable.

- Put appropriate systems in place to ensure that all insulation is made good following any maintenance or repair works within one month following the repair.
- The company will keep comprehensive records of all inspections, and actions taken to repair or upgrade insulation. The records should be available for independent audit.
- It is realised that in some cases actions may not be possible for other reasons such as physical constraints, design, or safety considerations. Where this is the case the company will need to be able to justify this lack of action, and should keep a record of this justification.

2.8 Waste Heat Recovery

- The company will annually inspect and assess the performance of key elements of heat recovery systems (e.g. heat exchangers and fans) and will ensure that they operate correctly on an ongoing basis.
- In the first year of the Agreement, the company will examine the potential to recover waste heat and install waste heat recovery systems where appropriate (e.g., combustion air preheating).
- The company will minimise the dumping of heat due to mismatched sources and loads.

2.9 Economisers

- In the first year of the Agreement, the company will review the possibility of installing an economiser on its main boiler(s) and will install where (i) fuel type allows; (ii) the technical and economic criteria in this Agreement are met.
- The company will carry out an annual inspection and assessment of the operation and performance of existing economisers to ensure that they continue to operate correctly.

2.10 Replacement Equipment

- Life cycle costs (see Section 1 - Energy Management – above) will be used when purchasing new or replacement equipment.
- In the first year of the Agreement, the company will assess the possibility of replacing boiler plant with newer plant that better matches the load requirements on site.
- In the first year of the Agreement (and thereafter when major changes are planned), the company will review the possibility of replacing inefficient generation or distribution equipment with more efficient equipment. This can include decentralising main boiler plant when boiler(s) need to be replaced, where there are considerable distribution losses, or where the load can be better matched through localised steam or hot water production.
- The company will ensure that the optimum heat transfer medium (i.e., steam at correct pressure, or correct temperature water) is used on site.

3. Steam and Hot Water Distribution

3.1 Pipework and equipment insulation

(This category of actions refers to minimisation of heat losses on equipment, pipework, flanges and valves in the hot water/steam/condensate system.)

- At the start of the agreement, and for the duration of the agreement, ensure that all pipework, flanges and valves are insulated at least to BS5422:1990 or equivalent standard, including standards for the insulation product and the installation of insulation.
- For the duration of the agreement, ensure that all new/replacement insulation fitted is in accordance with the BS5422:1990 or equivalent standard as a minimum.

- Carry out a full annual inspection of insulation quality and installation, and repair and make good any defects as soon as practicable. The inspection should include inspection for physical damage of the insulation and ingress of moisture.
- Put appropriate systems in place to ensure that all insulation is made good following any maintenance or repair works preferably as part of the task, but at least within one month following the repair.
- The company will keep comprehensive records of all inspections, and actions taken to repair or upgrade insulation³⁰. The records should be available for independent audit.
- It is realised that in some cases actions may not be possible for other reasons such as physical constraints, design, or safety considerations. Where this is the case the company will need to be able to justify this lack of action, and should keep a record of this justification.

3.2 Steam traps and leaks

- Regular inspections will be carried out of the steam distribution system for steam leaks, which should be identified and dealt with on a cost-effective basis. Areas to check include pipework, flanges, connections and steam traps.
- A system will be put in place to ensure rapid rectification of steam leaks.
- Records will be kept of the inspections, and of reported and rectified steam leaks.
- In year one of the Agreement, assess steam trap design, selection and installation on major plant and heat loads, and modify as appropriate to ensure optimal system performance.

3.3 Redundant pipework/Resizing

- Review the existing steam distribution pipework. This review should be at the start of the agreement and also after any significant process change.

- Examine thermal distribution system in order to identify long pipe runs with small users at the end, and take action to remedy.
- Redundant pipework should be removed when not needed or, depending on cost, isolated properly using blanking plates.
- Re-routing and resizing of pipework should be carried out where this could lead to energy savings.

3.4 Condensate recovery

- In year one of the agreement, companies will review the opportunities for condensate recovery and, where not possible to recover condensate, examine heat recovery options and implement where technically and economically feasible.
- Records of the review should be kept, and any viable opportunities should be taken within a reasonable timescale.
- Establish condensate return rate and ensure that it remains at the optimum level for the plant.

4. Minimising Steam and Hot Water Demand

4.1 Water Heating / Calorifiers

- Ensure temperature controls are in place to maintain water temperature at minimum required setting.
- Ensure time controls are in place to heat water only when required.
- Consider alternative heat sources for periods of low demand, and implement where technical and economic criteria permit.
- Examine the potential for replacement of supplementary calorifiers with waste heat from process plant, and implement where technical and economic criteria permit.

4.2 Space heating

- Carry out an annual inspection of heat transfer components (e.g. AHUs, radiators, unit heaters and direct fired radiant systems) to ensure that they are operating correctly, and repair and make good any defects as soon as practicable.
- Carry out an annual check of controls and control settings to ensure that they continue to operate correctly.
- Ensure adequate temperature and time controls are in place so that space heating only operates when required.

³⁰ For such records, SEI would provide a standard template to facilitate this and other recording of required assessments and actions.

II. Final agreements text

A Technology Agreement - Annex B: Benchmarking against Best International Practice

1. Introduction

The purpose of this Agreement is to ensure that participating sites operate their thermal energy plant and equipment as near as possible to Best International Practice (BIP), within the constraints of:

- Existing high-cost plant and equipment which is sub-optimum from an efficiency point of view but which has a considerable remaining operational life at the time of concluding the Agreement;
- The economic and technical criteria that form an integral part of the Agreement.

BIP values (ranges) for both generation and distribution efficiency were included in the thermal energy audit template used in the pilot project, and these were used to benchmark the energy performance of the 15 sites against BIP. The actions included in this Agreement (Annex A) have been assessed for their likely impact in terms of raising participating sites' efficiencies towards BIP levels. BIP efficiencies (generation and distribution), and the minimum expected efficiencies arising from full implementation of the Agreement, are summarised in Table B.1 below³¹.

2. Required benchmarking by participating companies

- a The company will measure and record overall generation and distribution efficiency of its thermal plant, at the beginning of the Agreement, and updated on an annual basis (see also Section 1.4d in Annex A above).
- b The company will regard the efficiency values quoted in Table B.2 (column 3) as benchmark targets for its thermal plant. Where measured efficiencies fall below these benchmark values, the company will assess all outstanding actions within the Agreement with a view to determining how close and how quickly it can attain the benchmark values. Where a significant shortfall remains even after taking into account the expected impact of the actions in this Agreement, the company will:
 - Carry out an analysis to determine the main reasons for such a shortfall;
 - Endeavour to take additional steps to reduce or, where feasible, eliminate the shortfall.
- c The Agreement acknowledges that the phased nature of implementation of actions over the life of the Agreement means that the benchmarks represent a final target. Interim benchmarking will take account of outstanding actions remaining to be implemented, in assessing any gap between benchmark and actual efficiencies.

3. Use of the benchmarks to confirm compliance

Where the expected generation and distribution efficiencies (Table B.2 column 3) are attained by the company on an ongoing basis, then this may be accepted as the sole required evidence of compliance by the company with the Agreement. Assessment of the extent to which each action in the Agreement has been implemented will only be carried out where there are doubts as to the reliability or sufficiency of the overall efficiency measures, or where there is some other requirement to carry out a full compliance check of the company's activities.

Where disputes arise in the interpretation of benchmarks and other indicators of performance, recourse shall be had by either side to the Agreement to an agreed independent auditor³².

1. Efficiency measure	2. BIP efficiency – expected range	3. Expected efficiency from implementation of Agreement
Generation efficiency*	$W^1 - W^2$	X
Distribution efficiency*	$Y^1 - Y^2$	Z

*These categories are indicative. It may be necessary to benchmark more specific elements of the generation and/or distribution system in some cases.

Table B.1 BIP generation and distribution efficiencies; expected generation and distribution efficiencies from full implementation of the Thermal Agreement

³¹ Since this Annex is intended to record an agreement in principle to adopt generation and distribution efficiencies in the manner described, and since a full project would be required in order to determine a precise methodology for measuring efficiencies (and determining actual benchmark values), figures are not at this stage included in Table B.1.

³² The full Agreement would stipulate a more detailed set of procedures on arbitration in the case of disputes.

II. Final agreements text

A Annex C: Treatment of CHP

1. Introduction

This Annex addresses the treatment of Combined Heat and Power (CHP) in the context of the pilot project on Negotiated Energy Agreements, and specifically the technology (horizontal) negotiated agreement on thermal energy, hereinafter termed "the Agreement".

The application of good thermal energy practice, underwritten by participation in the Agreement, is a pre-requisite for good CHP. However, CHP is a distinctive technology, with environmental and cost impacts far broader than the scope of an agreement focussing on thermal energy alone, including an important impact on electrical energy. While it is the view of the parties that a parallel technology agreement on electricity would be desirable in order to address the significant potential for emissions reduction from electricity production and use, it is possible that the treatment of electricity within an energy/ carbon tax system may hinder the development of such an agreement. For these reasons, it is appropriate to address CHP by means of this Annex to the Agreement, which otherwise focuses on thermal energy alone.

Rather than constituting a draft agreement on CHP at this point, this Annex represents an agreed position between the parties on a set of issues and options which might lead to conclusion of a negotiated agreement or equivalent support framework for CHP.

It should be noted that while recognition is given in this document to possible approaches to electricity for export, the focus is on treatment of CHP installed for the primary purpose of on-site energy usage.

2. Issues in relation to the treatment of CHP

- Both parties to the Agreement recognise the important contribution that CHP can make to reducing energy-related CO₂ emissions.

- Some organisations participating in the Agreement already have CHP plant in operation. Furthermore, a number of the audit reports produced as part of the pilot technology agreement project included installation of CHP as one of the recommended actions.
- However, the installation of CHP typically represents a large investment relative to any other single investment in energy efficiency. Although the consequent reduction in emissions can be high, under present conditions the financial payback period is longer than that for most other investments covered by the Agreement. For a given site, if CHP were included in the package of actions specified in Annex A of the Agreement, it would likely lead to the package payback exceeding the threshold 'package payback' criterion of 3.5 years and, in turn, to removal of other important actions from the overall package.
- Moreover, apart from its own financial weight, CHP can significantly alter the economic viability of other energy efficiency actions, including some of those related to thermal efficiency.
- Notwithstanding the above complications, it is recognised that where a given site is suitable for its installation CHP has the potential to yield in some cases the largest single emissions reduction arising from any single energy efficiency action. As such, there is a case for addressing CHP either in the context of negotiated agreements in general or of this Agreement in particular.
- It is understood that CHP is currently the subject of broader policy discussions³³ with a view to addressing the barriers to its uptake and its possible incentivisation, given (a) the desirability of increasing market uptake of CHP in Ireland, and (b) the generally unfavourable economic climate for CHP at present. It is generally recognised that CHP needs treatment beyond the scope of negotiated agreements. Policies abroad have included enhanced capital allowances, special financial packages, and special treatment in respect of energy/carbon tax³⁴. The aim of such support policies (including CHP agreements) is typically to reduce the financial uncertainty surrounding CHP, and to create a more favourable financial context for the installation and use of

- CHP.
- One of the possibilities could be the inclusion of CHP within a negotiated agreement, and this could represent a useful element within a broader package of measures. The potential impact of CHP on a site's energy performance is such that it would most likely be better to treat it in a horizontal negotiated agreement separate from the more general thermal Agreement to which this is an Annex. However, it must also be recognised that the thermal agreement and any agreement on CHP would almost certainly have to be linked. The view adopted here is that an organisation wishing one or more of its sites to participate in a CHP agreement must also sign up the same site or sites to the thermal agreement, and a site participating in the thermal agreement *may*, where the conditions are appropriate, also participate in the CHP agreement.
- In order to create a level playing field, a CHP agreement would have to be available both to sites which already have CHP and to sites agreeing to install CHP as a condition of their participation in the agreement.
- It would be imperative that the only CHP (whether new or already in place) eligible under such an agreement is 'good CHP', in that (a) its thermal output is utilised to its optimum; and (b) the plant is operated according to principles of good practice.

3. Possible components of a horizontal negotiated agreement on CHP

- Because the thermal and CHP agreements might be implemented either on their own or together, it would be necessary to link the two agreements, in terms of any tax exemptions that would be applicable (see below).
- The CHP agreement would cover both existing and new CHP installations. In both cases, the CHP installation would have to be significant and be 'good CHP', possibly adopting the definitions and frameworks from the recent Electricity Directive, or from, for example, the UK Climate Change Agreements.
- While it is beyond the scope of this Annex to specify the content of an agreement on CHP, both parties to the thermal Agreement consider that a form and level of financial incentivisation similar to that outlined in the table below³⁵ could provide an appropriate framework and approach to such an agreement.

Agreement	Level of tax exemption
Thermal agreement (on its own)	80% exemption on all fuel input to site
Thermal agreement plus CHP	As for thermal agreement only, but with 90% exemption on fuel associated with the thermal output segment from CHP plant

³³ This Annex in no way should be read as indicative of any policy decisions to be taken regarding incentivisation of CHP, and the text herein is entirely without prejudice to any future decisions on CHP.

³⁴ For example, in the UK all inputs to 'good quality' CHP plant (Quality Index = 100 [95 at initial operation]; Power Efficiency = 20%) is exempt from the climate change levy. In Denmark and the Netherlands, inputs to CHP for electricity are exempt from energy tax, and CHP enjoys a range of other support measures.

³⁵ The figures in the table are indicative only, and are without prejudice to any future negotiation on a CHP agreement. However, they illustrate a possible approach, and the figures shown are felt by both parties in the thermal agreement pilot to embody important principles for a CHP agreement. The exemption shown in the table are based on the assumption that fuel associated with the electrical output segment from CHP plant would be treated in an equivalent manner within a horizontal electrical agreement.

4. Possible support measures for CHP outside of negotiated agreements

1. Support measures similar to those considered for supporting renewable energy may be appropriate for CHP. The interaction with climate change mechanisms, including energy/carbon tax and emissions trading, must be a key consideration in the design of such support measures, recognising that climate change mechanisms are not the only factor impinging on the economic viability of CHP. In all cases, it is important that any mechanism created to support CHP observe the following key principles:

- promote competitiveness by offering least cost solutions;
- offer clarity and consistency to both industry and authorities, with appropriate alignment of incentives to benefits;
- minimise intervention in the structure of the electricity market while maximising long term policy stability to protect investors; and
- incentivise electricity production from CHP to capture environmental benefits at least cost.

2. It may be desirable to offer separate measures to support CHP based on whether or not a facility (site) will be exporting electricity:

- A facility with a CHP system optimised on the basis of the heat demand, but producing equal to or less than the facility's electricity demand, will use most of the electricity generated and export insignificant amounts to the grid. In this case an electricity production-based incentive mechanism may not be appropriate or practical to administer. Options that might be considered are:
 - New CHP capacity could be stimulated with capital support mechanisms such as capital grants, accelerated capital allowances, investment tax credits, or low interest rate loans.

- Incentives can be designed based on the additional input fuel needed for CHP above what would be required in a thermal energy only system. Tax exemptions on fuel, within a negotiated agreement or based on an excise fuel tax, could be offered, or a rebate on annual fuel purchases for the proportion relating to electricity production, where reasonableness can be judged based on the facility's output or a consistent measure of energy cost to turnover.
- A facility with a heat demand that justifies a greater electricity capacity than the site's electricity demand would be exporting and selling electricity through the grid. In this case the most appropriate support may be a price support mechanism for the electricity exported, and treatment within the liberalised market structure that does not disadvantage CHP. Such treatment would equate CHP generated electricity to renewable energy sourced electricity. Examples of possible support measures include:
 - Priority dispatch for CHP generators and a floor price guaranteed for CHP operators selling in the liberalised market.
 - Feed-in tariff guaranteed for CHP for a specific period of time (e.g. 10 years) at a rate determined by the relevant government department offering a return on investment that will attract a desired amount of new grid exporting CHP capacity.
 - Competitive tender for long term power purchase agreements for a desired amount of new grid exporting CHP capacity with a price cap set by the relevant government department.
 - A production credit offered at a premium above the electricity sales price for every kWh exported to the grid from CHP production. The CHP generated electricity would be sold separately in the electricity market. The premium could be a fixed tariff per kWh, or could be indexed to the price of the fuel source.
 - Inclusion of CHP within an obligation and tradable credit mechanism. Supply companies within the electricity market would be obligated to purchase a portion of electricity

from CHP providers. CHP generators would be granted tradable credits for every kWh of electricity exported to the grid. The supply company can purchase credits either bundled with the electricity or separately from the electricity. The obligation is met by redeeming the required number of certificates. An obligation can be created for CHP only, or CHP can be included with renewable energy in an alternative energy obligation.

5. Phasing

Where a site signs both a thermal agreement and a CHP agreement, the total capital investment would be treated as a single investment package, and an investment plan drawn up such that necessary investments are more or less evenly spread over each of the four years of the agreements.

6. Limitations

- As indicated above, it may be inappropriate for fuel used for export of electricity to enjoy a tax rebate in the context of a negotiated agreement.
- Since different considerations apply to the development of collective and individual company agreements, the principles outlined above would not necessarily apply outside of the horizontal technology agreement on thermal energy (the Agreement) to which this is an Annex.
- Development of a parallel horizontal agreement on electricity might introduce further considerations in respect of CHP, which in turn could alter the parameters for CHP in the context of a thermal agreement.

7. The view of the technology agreement pilot project participants

It is the view of the participants in the Agreement that the above alternatives, or some combination, could represent a desirable approach to the treatment of CHP in relation to the Agreement. The actual approach to be adopted would, among other considerations, be guided by its potential for increasing market penetration of CHP in Ireland, and by broader policy decisions concerning CHP.

Worked Example – CHP and Negotiated Agreements

- Emissions and Tax Liabilities

Main assumptions are that the site in question has a 1MW thermal demand and a corresponding 1MW electrical demand. Conversion efficiencies for the CHP are 80%, the boiler 80% and the grid 40%.

i) Emissions with and without CHP

A. CO ₂ emissions where boiler plant provides the thermal requirement and electricity is from the grid are:	8,960.95 tonnes
B. CO ₂ emissions where CHP provides 100% of the heat and electricity requirements	4,330.5 tonnes

ii) Tax Liability for CHP with and without Agreements

1. No Agreement and no CHP Tax liability for a boiler plant and electricity from grid (tax rate for gas assumed to be €17.5/tonne of CO ₂ and 5% of electricity price)	€66,361.87
2. Thermal Agreement Only and no CHP Tax liability for a boiler plant and electricity from grid where there is only an agreement for the fuel input to the boiler plant	€36,048.37
3. Thermal and CHP Agreement Tax liability for a CHP site where there is only an agreement for the thermal fuel element of the CHP plant	€41,680.47
4. Thermal, Electrical and CHP Agreement Tax liability for a CHP site where there is an electrical and thermal agreement for the CHP plant	€7,578.40

II. Final agreements text

B Collective Agreement June 2003

Section 1. Introduction

Sustainable Energy Ireland (SEI) has been working with ten large energy-consuming companies from the chemical and pharmaceutical sectors to test a pilot model of negotiated energy agreement as a possible climate change abatement measure for industry. This process, running from August 2002 to June 2003, has entailed detailed energy audits at the sites of the ten participating to build a baseline picture of energy usage patterns and to identify all opportunities for efficiency gains. On the basis of these identified opportunities, negotiation has taken place in order to develop principles and methods by which each firm will convert the full set of possible opportunities into a specific action plan for itself that forms the basis of a notional four year energy agreement.

This document represents the outcome of the pilot negotiation process between Sustainable Energy Ireland and the group negotiators. It details agreed principles and frameworks, as well as setting out the requirements for compliance in the notional agreement. For the notional agreement, some of these elements will be of less relevance than others, since the firms are not required to undertake any implementation, and hence elements such as reporting and compliance will never actually take place. However, it is valuable to provide a full understanding of the framework to which firms are giving their notional commitment. The key sections deal with the notional set of management measures, project actions and special investigations required of the participating firms. The notional decision for a firm is whether the extent of these demands is acceptable within the context of the alternative option, which in this pilot project is full liability for the carbon tax of €17.50 per tonne CO₂ as set out in the note on contextual assumptions agreed by the negotiators.

This document represents the completion of the main phase of the pilot process for the participating firms. Firms are not required to undertake any of the measures set out in the notional agreement, but may wish to incorporate elements within their own energy programmes.

SEI will, by the end of June 2003, complete its full report on the pilot project, and will incorporate the views of the participating firms in this report. This will then form an input to government in the development of a coherent policy response to the climate change abatement goals of national policy, as set out in the National Climate Strategy.

Contents

Part 1 Outcome of negotiations	
Section 1	Introduction
Section 2	Scope and principles of the agreement process
Part 2 Agreement content	
Section 3	Requirements relating to energy management
Section 4	Requirements relating to energy investment projects
Section 5	Requirements relating to special investments
Section 6	Agreed notional timetabling, reporting and compliance rules
Appendices	
Appendix 1	Energy management
Appendix 2	Investment action list

Section 2. Scope and principles of the agreement

2.1 Basis of negotiated agreements

The notional framework is that of binding action-based agreements, with firms committing to a set of:

- Energy management improvement measures
- Specific energy investment actions
- Special investigations on potential actions where significant uncertainty exists at present

The overall goal of these measures is to reduce the CO₂ emissions associated with energy use at the site. The notional framework sets a context of a carbon tax on all fossil fuel related energy streams, with an 80% rebate available to firms complying with this agreement. The details of the taxation measure and the rebate available are set out in Section 2.5.

The agreements are taken to be of four years duration, commencing on January 1st 2004. Annual self-reporting, with spot checks, is taken as the notional compliance process. The penalty for non-compliance is taken to be full liability for the assumed carbon tax for the full duration of the agreement.

2.2 Scope of agreements

All energy related techniques/technologies covered by the agreement type. All agreements to include action to ensure companies have best practice energy management systems/structures in place.

2.3 The notional nature of the pilot agreement

This agreement represents the outcome of the SEI pilot project on negotiated agreements, undertaken on the basis that participating firms are under no obligation to implement any of the measures contained herein. However, since the process reflected reality in as much as was practical, by signing the declaration of acceptance of the project, firms acknowledge that the action programme set out

represents a rational and desirable energy programme, the implementation of which would bring the firm towards Best International Practice in energy efficiency.

2.4 Principles of the pilot agreement

An underlying spirit of collaboration has guided the project and good working relationships have been maintained throughout. The following principles have framed the analysis and negotiation phases of the project.

Beyond business as usual

The National Climate Change Strategy clearly states that any carbon tax rebates associated with negotiated agreements will only be available on the basis of firms moving significantly beyond business as usual in terms of energy efficiency performance.

Moving towards Best International Practice on an economic basis

Again taking the policy signal from the National Climate Change Strategy, the intent of an agreements measure is to facilitate an accelerated move toward Best International Practice in energy efficiency. The pace of this path will be guided by economic considerations.

Protecting competitiveness

Competitiveness has been a stated concern of the project from its inception, and protection of firms' competitiveness remains an important component of the analysis.

Raising the strategic importance of energy efficiency

The long-term imperatives of climate change abatement and the required shift towards a carbon constrained economy dictate that energy efficiency become a strategic issue for all firms. The agreement's emphasis on energy management and systems, as well as specific investment actions, aims to enhance the profile of energy efficiency and emissions abatement at senior level in all firms.

Credit for early action

Firms that have already taken action on energy efficiency have a reasonable entitlement to receive credit for this and to be judged on an equitable basis with those that have not yet done so. The action-based design of this pilot agreement should ensure that firms are compared equitably and participants will be assessed on the basis of the gap between their current practices and Best International Practice.

2.5 Assumed taxation mechanism for compliance

The pilot project assumes that the mechanism for compliance with the notional agreements is a carbon tax, for which rebates are given for agreement participants. This is in line with national policy, and indeed proposals for a carbon tax in Ireland are progressing, with an introduction date signalled as the end of 2004.

For the pilot project, a tax on all energy streams based on their carbon content is assumed.

Based on comparison with a range of carbon tax mechanisms in other states, a carbon tax level of €17.50 per tonne of CO₂ is to be assumed as the full level of tax payable by firms not participating in a negotiated agreement. This sets the notional tax at a comparable level to other states.

In the pilot project, firms who reach a notional agreement will receive an 80% exemption from the carbon tax. The rebate will be available from the first calendar year of the agreement, i.e. 2004 in this case. For simplicity, the pilot project assumes that the rebate for participating firms will be delivered directly through a reduced demand for taxation payments on an ongoing basis.

Within the pilot project, energy from renewable sources is assumed to be exempt from carbon tax.

2.6 The contingent nature of the agreement

The assumptions set out in this section, based on the set of assumptions agreed by the parties on March 6th, determine the notional cost of non-compliance to firms in the pilot project, and hence significantly influence the outcomes. All parties acknowledge that the contents of the agreement are contingent on these assumptions and should not be interpreted as a likely or valid outcome from any future agreement measure based on different design parameters or contexts.

2.7 The limits of the pilot project negotiations

In order to set boundaries on the pilot project, certain related policy issues were not fully incorporated into the negotiations.

In the first instance, CHP was treated by agreement on an action basis, that is, a potential action for certain sites and one that has already been implemented at other sites. Those firms with CHP already installed were rewarded in the agreement process in that the possible inclusion of CHP installation as an action was precluded, tax levels would be lower due to greater efficiencies; and, thirdly, economic evaluations of project would be in a number of cases less favourable due to the better efficiencies created by CHP, and thus the action lists for those firms would presumably be shorter.

However, SEI recognises the firms' argument that CHP merits particular attention in the policy domain, and that the basis of this pilot agreement is not adequate to fully realise the potential of the technology in Irish industry. It has not been the intent of this pilot to fully address the policy elements of CHP in Ireland, and further, separate consideration of this issue is required. The project assumes that other incentives or rewards for CHP will be in place in conjunction with the agreement measure being tested in this pilot.

Similarly, the pilot project assumed that any revenue recycling of the tax paid that took place would not be in the form of direct grant aid to firms, particularly in relation to the firms stated preference for grants associated with special investigations. As is stated in Section 5 of this appendix, such grants would clearly leverage additional activity on these special investigations, otherwise bound in their potential by resource constraints.

In these and other cases, there are many interactions between the tested agreement measure and other existing or possible future policy dimensions. However, in as far as was possible, the pilot project was conducted in isolation from such considerations.

2.8 The end point of the pilot project

As set out in Section 4 of this appendix, the process of firms joining the type of agreement measure developed in this project involves a final self-assessment stage where the broad, collated set of actions is analysed by each firm for its own site, against the set of principles agreed in the negotiations. The result of this self-assessment would be a proposed list of actions to be undertaken, including a scheduling of these actions over the four years of the agreement. This programme, once approved by SEI, would then be the material content of the agreement for that firm.

However, largely for reasons of practicality, firms are not asked to undertake this final self-assessment exercise. The end point of this agreement pilot is the signature of the firm's chief executive on a note of principle stating that the firm accepts the validity of the process and the principles agreed and would, were this a binding agreement, now undertake the self-assessment to produce the set of actions required for compliance.

2.9 Information base for pilot project

The pilot project is based on the results of the ten energy audits, but it is agreed that the information base would need to be stronger in a full agreement. This is due to the learning process in guiding audits and developing an audit template, and also due to insufficient engagement with the auditors on the part of some of the participating firms.

Firms expressed concerns about the accuracy of many estimates of investment costs for actions identified by the auditors. In order to address these concerns, several adjustments were made to the data set:

- In cases where firms had specific additional information from analysis or from suppliers, investment estimates were adjusted. This was done to improve the information base in the pilot project, but in a binding agreement would require additional verification steps. About ten projects were adjusted on this basis, with about five more being removed from the action list to the category of special investigation due to uncertainty.
- All projects said to have zero investment costs were adjusted to a baseline of €1,000 investment estimate. This is to reflect the reality of costs implied by all actions even if no capital investment is required. 33 projects were adjusted on this basis.
- Projects involving equipment write off would involve an additional cost due to this write off. Initial analysis identified 4 projects that may involve write off of existing equipment. If these or other projects are identified as involving equipment write off, firms may include the additional costs of this while carrying out the self-assessment exercise to assess the projects for their own site.

In total approximately 50 projects out of a total of about 140 were adjusted on the basis of the above considerations.

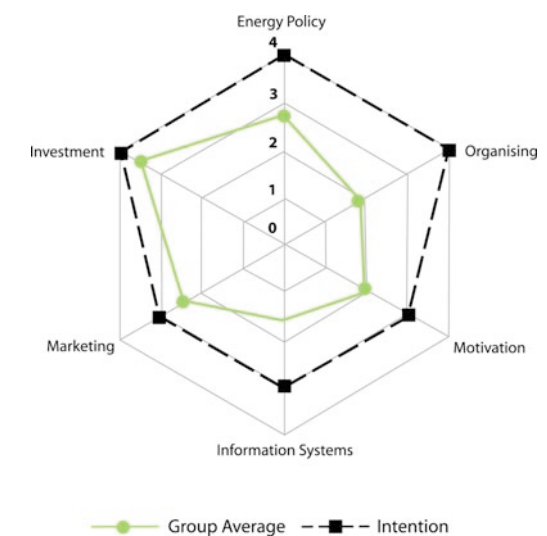
To further analyse the quality of the investment estimates, Future Energy Solutions, as part of its role as quality assurance consultant in the pilot project, examined a sample of projects and spoke to the firms and auditors about their view of the quality of the estimates. A number of actions were considered to be based on reasonable estimates by all parties, including the firms. However, there were also a number of cases where it was clear that the investment analysis was based only on capital costs, and did not incorporate ancillary costs. Overall, the results of this analysis were inconclusive, acknowledging the uncertainty inherent in all initial estimates, but not finding a systematic pattern of underestimation.

The self-assessment exercise envisaged as the final step in the agreement model being tested in the pilot, but which will not be fully undertaken in the pilot project, represents the opportunity for firms to make the case for additional costs associated with projects not included by the auditors. In projects where ancillary costs have not been included, or where the auditor seems to have underestimated costs in general, the firm will be able to make the case for its estimate of the true costs of the proposed project, subject to the same processes of verification as other elements of the agreement.

In summary, approximately one third of project investment estimates have been adjusted to reflect various concerns, and other inputs to better estimation can be made during the self-assessment process envisioned. On the basis of this, the data set is now taken as adequately robust to complete the pilot project. It is acknowledged that some uncertainty remains in a number of cost and impact estimates and that a binding agreement process would require stronger verification of these estimates. The understanding of the pilot project is that firms would be asked to carry out projects on the basis of their final economic analysis, and in all cases projects would require further study to confirm expected costs and impacts before implementation.

Section 3. Requirements of the agreement relating to energy management

Analysis of energy management practice and goals is based on the energy management matrix. Current performance among the ten participating firms has been assessed through the audits as shown in the figure below. This negotiated agreement requires participants to strive for Best International Practice in all aspects of energy management. Within the context of this pilot agreement, this is taken to mean moving towards level 4 on all six dimensions of the energy management matrix, meaning level 4 achieved under three headings, and level 3 achieved or exceeded on the other three headings:



The following table sets out the detail of what these objectives imply under the six matrix headings:

Further detail on the requirements for energy management under these headings is given in Appendix 1 of this document.

Heading	Summary	Actions Required
Energy Policy (Level 4)	Energy policy, action plan and regular reviews have commitment of top management as part of overall environmental strategy. Policy is available internally and externally.	<ul style="list-style-type: none"> - Policy is publicly available and is understood at all levels of the organisation. - Energy brief is assigned to one senior manager at 'Head of Function' level. - An action programme of continuous improvement is in place. - Energy performance is formally reviewed on a regular basis by senior management. - Policy is reviewed and updated on an ongoing basis.
Organising (Level 4)	Energy management fully integrated into management structure. Clear delegation of responsibility for energy consumption.	<ul style="list-style-type: none"> - User departments can readily explain their current energy usage patterns. - An energy manager must be specifically appointed, although not necessarily as a dedicated post. - Energy committee is in place and supports the role of the energy manager. - Responsibilities and action programmes for achieving goals have been delegated. - Resources for the attainment of energy efficiency goals are defined and allocated. - An annual report on energy performance is submitted to the organisation's board or equivalent level.
Investment (Level 4)	Investment approval rules positively favour energy/environmental projects, with detailed investment appraisal of all new-build and refurbishment opportunities.	<ul style="list-style-type: none"> - All investment decisions have regard to their energy efficiency implications. - All investment in significant energy consuming equipment takes life cycle costing into consideration. - Energy efficient options are specified at design stage for new and refurbishment projects - Approval criteria are such that energy efficiency benefits confer investment projects with a greater likelihood of implementation. - Longer payback projects are included in a package of linked measures with an overall payback which is more favourable to allow 'enabling' projects proceed.

Heading	Summary	Actions Required
Information Systems (Level 3)	M&T reports for individual premises based on sub-metering.	<ul style="list-style-type: none"> - Comprehensive site evaluation of M&T needs is carried out. - Energy Accounting Centres (EACs) established. - Metering is in place to a degree that meets the informational needs of the energy management system, as informed by the initial evaluation. - Data is collated and analysed at a frequency dictated by complexity of plant. - Performance is benchmarked, including external benchmarks where feasible. - Targets are set for EACs. - Reporting to management and staff is regular and useful, and should stimulate further action and ongoing target setting. - Level 4 would imply fully comprehensive metering with systematic monitoring, fault identification, savings quantification and budget tracking.
Motivation (Level 3)	Energy committee used as main channel together with direct contact with major users.	<ul style="list-style-type: none"> - Channels of communication established both internally and externally on energy matters. - Energy committee is the main channel of communication with direct contact with main energy users. - Communication may be formal via company reports, publications and award schemes and informal through internal newsletters, intranet and training programmes. - Recognition is given to energy successes. - Level 4 requires that all channels of communication, formal and informal, are regularly exploited by the energy manager and committee at all levels.
Marketing (Level 3)	Programme of staff awareness and regular publicity campaigns.	<ul style="list-style-type: none"> - The benefits of effective energy management are understood widely throughout the organisation. - Energy awareness is regularly promoted, including annual campaigns. - Energy performance is communicated via staff notice boards. - External recognition, possibly including award schemes, is sought. - Level 4 means stronger and more systematic implementation of these elements.

The table above sets out the status of management required of firms in the agreement by the end of year 4. It is expected that progress towards these goals will be visible from the start of the agreement, and that annual reports will be able to demonstrate steps taken towards the goals. Investment in energy management will be expected to pass the same tests of economic rationality as the specific investment actions discussed in the next section.

Section 4. Requirements of the agreement relating to specific energy projects (actions)

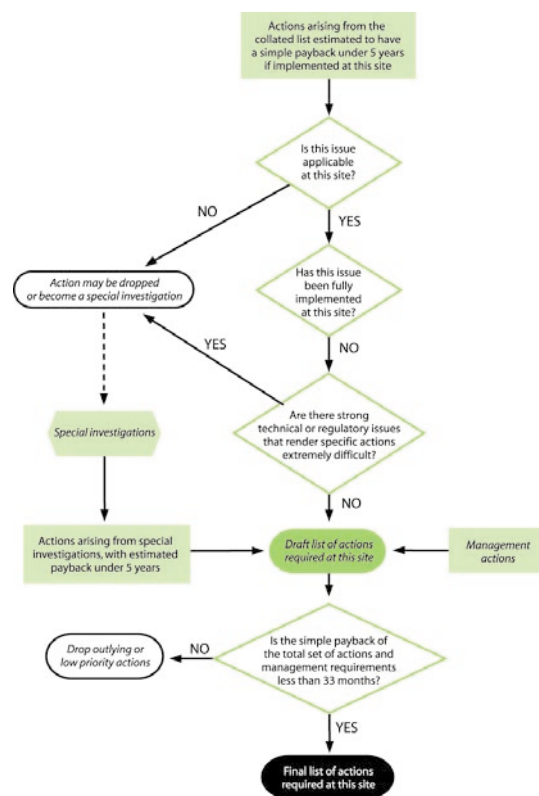
A generalised list of actions has been drawn up from all of the audit reports, and is presented in Appendix 2 of this document. These actions have been grouped by category of action. Each category of action will be addressed by the firm in the manner detailed below. Firms will initially consider each action on the collated action list and apply the following tests to determine whether the action should be undertaken at their site:

Principles of assessment:

1. Any action with a simple payback of greater than 5 years can be excluded.
2. The firm will check that the category applies to its operations. If not, the category may be skipped.
3. The firm will consider the general principles of the action category in relation to its own position and assess the actions contained within it according to the following criteria:
 - Has the issue been fully addressed, and implemented where appropriate, at this site? If so, no further action is required.
 - Are there strong technical or regulatory issues that render specific actions extremely difficult? If so, and if the firm wishes to exclude such an action, arguments must be submitted with the action plan. Depending on the degree of uncertainty, it may be appropriate for such items to become the subject of special investigations.
4. The firm will include the recommended actions from its own audit report and also allow for the addition of actions arising from special investigations. This creates the draft set of all actions required of the firm
5. This draft list, along with required management actions, is then considered in terms of the total investment required. The overall simple payback of the full set of actions set out in the plan will not exceed 33 months. If this payback is exceeded, outlying or low priority actions may be removed.

6. The general principle of maximising CO₂ abatement impacts will apply. This means that projects with higher CO₂ impacts should be prioritised. In cases where assessment of the action lists suggests that economic criteria will be exceeded, lower CO₂ projects should be deferred to make room for higher CO₂ projects as appropriate.

Representing this process diagrammatically:



Once this assessment is carried out, the firm will submit a report to SEI detailing the process of translating the generalised action list into a specific action plan for the firm, to be checked and approved by SEI. The submitted report will be based on a structured list of the full set of actions with each action either accepted or information provided as to why the action is not applicable. Firms may wish to propose other projects they have identified that will achieve the CO₂ impacts in more efficient ways. This report, once accepted, will form the basis of the finalised notional agreement between the firm and SEI.

Section 5. Requirements of the agreement relating to special investigations

The main focus of the agreement is management and specific actions. New management practices taken on board as per Section 1 should create systems that routinely identify and evaluate new energy project opportunities, and it is expected that such investigations and projects will arise over time. However, a certain number of specific investigations merit attention in the agreement in order to:

1. Allow further consideration of identified projects with significant potential impact, but for which some technical uncertainty remains.
2. Encourage consideration of large projects with attractive potential impacts but whose economic evaluation puts them outside the remit of this four year agreement.

Each firm's agreement will include a list of special investigations to be carried out within the lifetime of the agreement, with broad milestones for the submission to SEI of the results of these investigations. Once an investigation is completed, if the action under investigation passes the assessment criteria detailed above, the action should be added to the firms action plans for commencement within a reasonable timeframe as agreed with SEI.

The full set of special investigations for each firm will be based on:

- Investigations specifically identified in a firm's audit report
- Investigations of actions with significant CO₂ impacts which have been deleted from the action list for reasons of technical, economic or regulatory uncertainty
- Additional investigations identified by the company (particularly in the context of enhanced energy management and prioritisation), considered to be of more value than those above.

From this list, the firm will develop a prioritised plan of investigations over the duration of the agreement subject to a maximum total expected spend on investigations. This maximum annual spend is set at 2% of the total investment required to carry out the programme of management and investment actions arising from the previous sections. SEI recognises that such investigations will be constrained by resource availability and that, in the absence of an external support mechanism, the number of special investigations undertaken will be limited.

Section 6. Agreed notional timetabling, reporting and compliance rules

6.1 Agreement timetable

The agreement is notionally set to cover the period January 2004 to December 2007. In general, the reference year for baseline data has been the calendar year of 2001.

When firms carry out the self assessment exercise in order to establish the list of actions required of them, they will be expected to develop an approximate schedule for these actions in terms of implementation over the four year agreement. The overarching principle for this scheduling should be that, since tax rebates are available from the start of the agreement, action should be taken from the start and the level of action should be broadly even over the life of the agreement.

Experience in other states suggests that, if action is distributed broadly evenly over the period of the agreement, achievement of CO₂ emissions reductions will be greater in the earlier part of the period. This is due to the availability of relatively easy savings opportunities. However, the model of this pilot agreement is that of commitment to actions, and so the time profile of CO₂ impacts is not relevant to compliance considerations.

Where feasible, special investigations should be scheduled towards the earlier part of the agreement period, to allow those that result in significant project opportunities to be implemented within the timeframe of the agreement.

The next section sets out reporting milestones for the project. Firms will be expected to demonstrate in these reports that they are meeting their obligations in terms of implementing agreed management steps, actions and investigations as set out in the schedule. Significant slippage will result in a firm being considered to have failed to comply with the agreement.

In this notional agreement, the extent of relevance of timetabling is to agree the overarching principles contained in this section, that of scheduling agreed measures evenly across the lifetime of the agreement, and in particular ensuring that action would commence immediately and not be back-loaded towards the end of the period. Since no commitment to action results from this pilot project, there is obviously no formal commitment to a schedule of actions.

6.2 Reporting schedule

The model for this pilot agreement involves annual reports from participating companies to report on progress and verify ongoing compliance. It is assumed that some form of external spot check procedure would be in place. Over the four-year period of the agreement, the following notional reporting schedule is assumed:

Interim reports and reviews: September 2004
September 2005
September 2006
Final report and review: September 2007

Each September, the firm would notionally submit a short report based on a form developed by SEI that would detail progress on management, project and investigation elements of the agreement. Energy and CO₂ data would also be gathered, and the firm would formally assert that it considered itself to be in compliance with the terms of the agreement. Subject to SEI checking, this would then be the basis for the firm continuing to receive the carbon tax rebate for the following year. Notionally, the final review in September 2007 would prepare for a new agreement from 2008.

6.3 Flexibility in the agreement

The nature of a negotiated agreement is to achieve the desired outcome in the most rational and economic way, giving the firms flexibility to make decisions about how this is done. Through the auditing and negotiation steps, this logic should be encapsulated in the agreed set of measures from the beginning of the agreement. However, it is recognised that changes will occur that affect the context within which projects take place, and which will alter the viability or desirability of certain measures.

A principle of flexibility is assumed in this notional agreement. Small changes in the set of measures undertaken are to be expected, and in general these are acceptable once the overall objective of CO₂ emissions saving is borne in mind. Thus if an agreed project becomes undesirable for some reason, there will be a general expectation that it would be replaced in the action plan by another of similar estimated emissions reduction impact, where possible. It is assumed that the rules of the agreement would require that firms notify SEI in advance of all such changes.

In cases of more significant contextual or other changes, it is assumed that mechanisms for renegotiation at various levels would be in place. Both SEI and the firm would be entitled to request of the other party that elements of the agreement be reconsidered during the agreement period. It is also to be assumed that some form of dispute resolution, based on independent arbitration, would be in place.

II. Final agreements text

B Collective Agreements - Appendix 1 Details of Energy Management Requirements

1. Energy Policy (Level 4)

In order to sustain superior energy performance, there is a requirement to ensure commitment from senior management. All management initiatives require clarity in terms of direction and link to corporate strategic goals and this corporate energy policy should take the form of an official, publicly available statement of the organisations commitment to achieve energy management objectives and to reduce energy related emissions. Absence of top-level commitment means that the energy policy will not become fully integrated into the underlying culture and ethos of the business. An unofficial / informal policy may be destabilised by a change in personnel or the wider business environment. Therefore the energy policy should integrate with existing policies to provide continuity and ongoing relevance to the organisation.

Senior level commitment should be maintained and reaffirmed by regular reporting and briefings of the benefits of the policy including; successful projects; wider contextual policy issues; ongoing action plans and investment priorities.

2. Organisation (Level 4)

However, maintenance of the policy is likely to occur at a level below that of Chairman or Chief Executive. Ideally, the level immediately below this - sometimes referred to as 'Head of Function' grade would take the ongoing management responsibility for ensuring that the principles of the corporate policy are implemented and achieved.

Introducing energy management will inevitably involve some change and in order to successfully introduce a new energy policy, the responsible manger should:

1. Communicate and champion their policy
 - the policy is to be seen by everyone as an important and integral part of their job responsibilities
2. Plan and organise their managers
 - bring key people together who can make the policy work locally
 - ensure that existing equipment is set up and working properly
 - measure current situation and introduce new energy saving proposals
3. Give a clear lead
 - define expectations; set long-term goals, medium term objectives.

Implementing the energy policy will involve a wide range of people. So to ensure successful implementation, it is important that clear lines of responsibility are established.

- Set up the energy management and reporting structure within the company, including an annual report to the group board or equivalent entity.
- Formally appoint an energy manager with clearly defined responsibilities
- Set up an energy committee consisting primarily of key energy users and supported by a dedicated energy manager or facilities manager.
- Arrange for the committee to devise short-term targets to achieve the medium term policy objectives. Set up a series of short and longer term projects, to achieve specific targets.
- Tell everyone what you are trying to achieve, and maintain regular two-way communication.

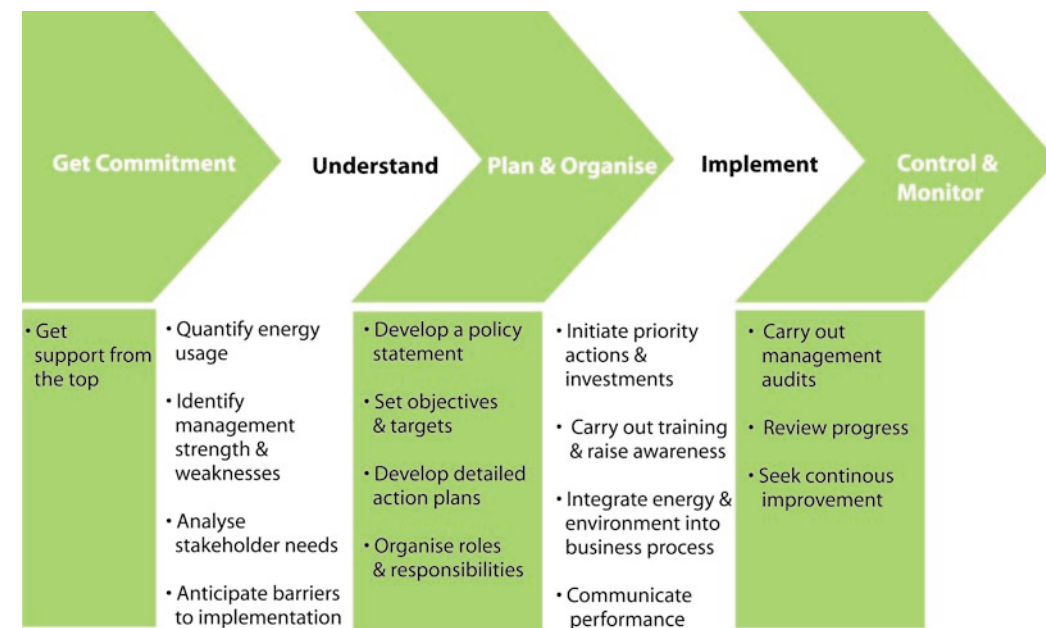
Senior executives should underline the importance of projects by requiring regular progress reports, and by publicising and endorsing success, which can further support individual motivation and commitment.

A company exhibiting level 4 in Organisation would have energy management fully integrated into the management structure with clear delegation of responsibility for energy.

Level within Organisation	Level of Commitment	Action
Top & Senior Management	Ensure energy goals align with business improvement programmes	Develop policy and assign energy brief to one senior manger. Review energy performance on a monthly basis as a minimum.
Middle Management	Accept energy objectives enhance & advance core objectives	Manage and organise the formal energy management structure. Ensure funding requests are sufficient to implement action plan. Produce regular reports.
Operational Staff	Agree energy targets as realistic & achievable	Implement energy management objectives and report to management on results.

Table 1. Organisational Responsibilities

UK Good Practice Guide 200 – 'A Strategic Approach to Energy & Environmental Management', introduces a systematic approach to setting up a formal system which is reflected in the energy management matrix employed in this agreement:



3. Investment (Level 4)

A company exhibiting level 4 in Investment would actively assess investment in projects with significant energy implications on the basis of total Life Cycle Costing (LCC).

The basic costing equation for total LCC can be expressed as follows:

Total LCC= initial investment costs, plus all future costs (operating, energy, maintenance, repair and replacement costs), minus salvage value (i.e., value of an asset at the end of economic life)

As life-cycle costs are spread over many years, they must be converted to a present time value (NPV) in order to make them directly comparable over a period of time. This technique brings the ongoing savings that accrue to energy efficient technologies into the investment decision-making process and therefore reduces or indeed eliminates the impact of the premium capital cost normally associated with more efficient equipment.

Similarly, all future benefits should be analysed to assess their present value. In particular the benefits associated with avoidance of new capital investment and the ability to meet stricter environmental regulations. Also the reduction in liability for an energy tax and the benefit of a 'green' image.

Further, the approval criteria for energy/environmental projects should include some positive discrimination whereby the 'normal' investment rules for the organisation are softened to provide a more favourable environment for decision making.

Procedures for considering and assessing the most energy efficient options should be established at the specification and design stage of any new or replaced projects / systems. All calls for tender for energy consuming equipments will routinely specify the most energy efficient options and assessment is based on overall operating costs as above.

Also, energy projects can often be relatively small when taken individually. Where possible, linked projects should be packaged together to develop sufficient critical mass. In this way the average overall payback of the investment is attractive which allows some important enabling projects of longer payback to be included.

4. Information Systems (Level 3)

An effective energy information system involves the collection, interpretation and reporting of information on energy use. Its role is to measure and maintain performance and identifies opportunities for reducing energy usage and costs.

It comprises a management approach known as Monitoring & Targeting (M&T), which aims to highlight where energy is being used, to track that usage, to develop plans and targets for ongoing energy savings, and to focus the attention of management and staff on energy use and the means to reduce that use. M&T is not simply an information system – a process of data collection and analysis using sophisticated IT equipment and software – although some M&T systems do rely on the use of IT.

Monitoring & Targeting

Definition - "The management of energy use by means of detailed ongoing measurement of consumption, establishing specific targets for savings, and implementation of planned actions aimed at meeting these targets."

M&T should provide clear indications of performance utilising Key Performance Indicators that are relevant to the organisation (energy use per tonne of product for example) and should include all factors necessary to demonstrate the achievement of the energy management targets or identify areas for improvement.

M&T typically works best in an environment where there are complementary management approaches in place, such as Total Quality Management (with its emphasis on participative approaches, and ongoing data collection and analysis). In such an environment, the various management systems support one another and provides a structure that ensures that the whole management team within the organisation focuses regularly on energy use and on targets and plans for reducing consumption

Depending on the nature of the organisation, there is typically a hierarchy of information related to energy use with levels such as the following:-

- Site level information can be derived from financial accounting systems—the utilities cost centre and involves bill analysis taken from general site meters
- Building or Department level information can be found in comparative energy consumption data for a group of similar facilities, utility billings, service entrance meter readings, building management system data, correlated with building use and weather or production data
- System level (for example, building HVAC or boiler plant) performance data can be determined from more comprehensive sub-metering data, subjected to regression analysis against key independent variables
- Equipment level information can be derived from nameplate data, run-time and schedule information, sub-metered data on specific energy consuming equipment

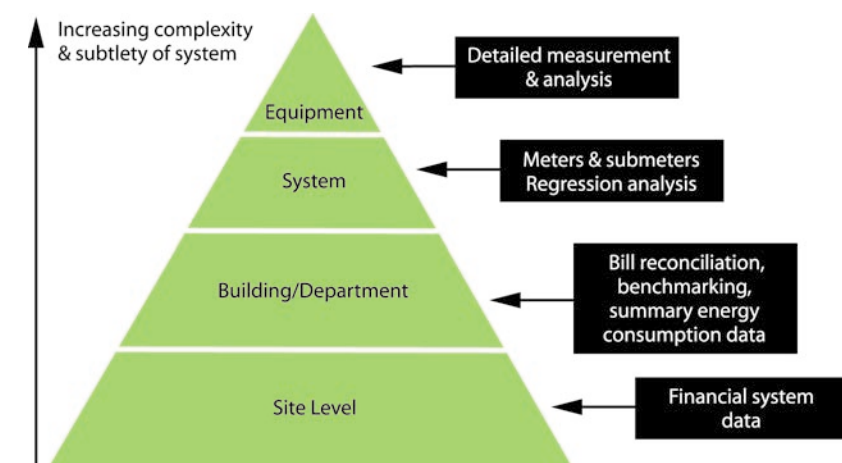


Figure 3. Hierarchy of Energy Information

An effective energy Monitoring & Targeting system should consist of the following: -

Audit

Any M&T programme must commence with a comprehensive site audit to provide the essential information required to identify any energy-saving potential and set realistic, achievable, measurable targets

Energy Account Centres

The Energy Account Centres (EACs) to be included in the M&T system are selected. This can be done from information provided by the audit, which will also have highlighted the need for any additional meters. The Pareto principle gives insight in to cost-effective sub-metering and aids optimisation.

Metering

Any new meters can now be installed and all existing meters checked. Any correction factors that need to be applied to the resulting meter readings can be calculated

Data Collection

It is necessary to collect information on the energy consumed and information on those things determining the amount of energy consumed. In the case of process, energy use is likely to be determined by the level of production. In the case of a building it is likely to be the weather. An important factor in information collection is the monitoring period. On high energy-using plant, daily readings may be necessary. In the case of commercial premises where the predominant energy usage is for space heating, monthly monitoring is more usual. The key principle is: "minimum energy information for maximum control".

Standard Setting

Once sufficient data has been collected for an EAC it is possible to set a standard. The standard can then be used to calculate the energy requirement of the EAC under any appropriate operating conditions.

Target Setting

A target should be set for each EAC at the same time as the standard is set. Individuals responsible for the performance of EACs will be expected to try to achieve the targets set and therefore the EAC managers should be given their targets before the M & T system commences full operation.

Reporting

Having started the monitoring process and established targets for each EAC it is important that weekly reports are issued to each EAC manager.

Action

Ultimately energy information and reports will not save money. Only action will deliver the savings. The reporting system should be such that each cost centre manager can see his/her performance and the effect of actions taken.

Research has shown that implementing a monitoring and targeting regime can lead to savings of between 5% and 10% of annual energy costs. Clearly the Pareto principle applies and, using the hierarchy of energy information pyramid above, one can quickly assess how detailed the M&T system needs to be in order to capture 80% of the energy usage. The optimum design of an M&T system, therefore, is one, which realises the maximum savings potential for the minimum cost.

5. Marketing (Level 3)

A high level of staff awareness is required for an energy management system to be effective. Many ideas and solutions come from staff, i.e. the users, so it is vital to provide suitable opportunities for their input. Staff may need training in energy saving techniques and use of equipment, but unlike traditional organisational training where new skills are taught, energy management training is more to do with building an awareness of energy issues and creating an environment where all users have a sense of ownership of energy matters on-site. The benefits of effective energy management will therefore be understood at all levels of the organisation.

Level 4 on marketing takes these principles further and makes awareness mechanisms more thorough and more systematic. The value of energy efficiency and the performance of energy management is marketed both within the organisation and outside it.

6. Motivation (Level 3)

Successful energy management needs to be well communicated throughout the organisation to ensure that the benefits are readily understood. The information needs to be communicated in a manner that is relevant to the target audience so that finance managers will be interested in cost savings; environmental managers interested in emissions reductions; marketing managers interested in the good corporate citizenship; etc.

Arising from the formal organisation of energy management within the organisation, the main communication channel will be the energy committee, together with direct contact with the major energy users.

Communications may be formal through meetings or via company newsletters, intranets, energy awareness campaigns and externally, through award schemes, company reports, Internet sites and bulletins. Annual awareness campaigns should be conducted. Energy 'champions', i.e. individuals who show commitment to and initiative on energy efficiency, should be given recognition.

Useful links:

http://www.greenhouse.gov.au/lgmodules/wep/setting_up/index2.html

<http://www.eere.energy.gov/femp/>

http://www.eeca.govt.nz/Content/pdf/pr2_k81.pdf

<http://dsm.iea.org/>

http://www.energystar.gov/index.cfm?c=industry.bus_industry

<http://www.e5.org/home.php>

http://www.seav.vic.gov.au/advice/business/energy_management/index.html

Reference Documents:

Good Practice Guide 186 – *Developing an Effective Energy Policy*

Good Practice Guide 200 – *A Strategic Approach to Energy & Environmental Management*

Good Practice Guide 119 – *Organising Energy Management*

Good Practice Guide 306 – *Energy Management Priorities*

Good Practice Guide 167 – *Organisational Aspects of Energy Management*

Good Practice Guide 84 – *Managing & Motivating Staff to Save Energy*

Good Practice Guide 112 – *Monitoring & Targeting in Large Industries*

Good Practice Guide 125 – *Monitoring & Targeting in Small & Medium Sized Companies*

II. Final agreements text

B Collective Agreement - Appendix 2 Investment action list

The following tables present the collation of the recommended investment actions from the ten audit reports produced as part of this pilot project. These tables are the basis for the notional exercise of firms assessing the suitability of the actions for each site and hence drawing up their own specific set of actions required as part of the negotiated agreement.

The envisaged self-assessment process is based on an assessment of each action category by the firm according to the principles set out in section 4 of this document. Firms would be required to complete a self-assessment form on which they would record their analysis of each action along the following indicative lines:

Action category

- Is this relevant at this site?
(If *yes* then proceed, if *no* then the action may be dropped or may become a special investigation)
- Has this issue been fully addressed at this site
- Are there major technical or regulatory barriers to this action at this site?

If the answer to the last two questions is no;

- What is the estimated cost of implementing this action at this site?
- What is the estimated energy savings return?
- What is the estimated annual CO₂ saving?
(include details of analysis)
- Does this action pass the economic assessment criterion?
If so, it should be included in the set of required actions.

The analysis of each action category within this framework forms the content of the notional self-assessment exercise that a participating firm would carry out as the last stage of development of an agreement for that firm.

In the following tables, projects with extremely unfavourable financial assessments have been removed. Also, some projects categorised as actions in audit reports fit more in the category of enhanced energy management practices, and so generally have been removed from these collated lists. Actions that are identified in more than one audit, and hence are more likely to have wider applicability, are presented in the first table. The second table lists those actions identified at only one site, but which may have applicability at other sites and should be considered by all firms.

Actions identified in more than one audit

Heading	Summary	Actions Required	Average estimated payback
Boiler Burner Controls (BBC)	Oxygen trim systems, DDC controls	€2,100 to €12,000, based on three identified projects	4.0 years
Boiler Management (BOM)	Boiler operational actions including sequencing and control adjustments	Generally low cost (€1,000). One boiler control project identified at €34,000	2.8 years
Economisers (ECON)	Installation of economiser for boiler heat recovery	€20,000 to €30,000, based on two projects	3.7 years
Compressed Air Leaks (CAL)	Adequate leak checking and repair as part of enhanced energy management	€1,000 to €2,500, based on three projects	0.4 years
Compressed Air Management (CAM)	Management of CA system, including the monitoring of compressed air usage, reduction of pressure and air temperature and the metering of the electrical usage of the compressors	€1,000 to €8,000, based on eight projects	1.5 years
Compressed Air Plant & Equipment (CAP)	Compressor reducing, control & sequencing, installation of shut off valves	€1,000 to €11,500, based on seven projects	2.4 years
Chilled Water Management (CHLM)	Revision of operation including changing set points, temperatures and pressures	€1,000 to €2,000, based on 15 projects	0.04 years
Nitrogen System Management (NTM)	Nitrogen vaporiser recovery, system monitoring and control	€4,000 to €11,500 based on two projects	1.5 years
Variable Speed Drives (VSD)	Installation of variable speed drives. A motor review to identify all VSD opportunities should be undertaken by all participants	€2,800 to €30,000 based on 20 projects	2.0 years

Actions identified in more than one audit

Heading	Summary	Actions Required	Average estimated payback
Steam Leaks (STL & TDL)	Identification and repair of steam leaks and steam trap malfunction	€1,000 based on three projects	0.1 years
Thermal Distribution System Management (TDM)	Heat recovery, adjustment of hot water settings	€1,000 to €20,000 based on three projects	0.9 years
Lagging / Insulation (LAG)	Insulation of pipework, flanges and valves in the hot water/steam/condensate systems	€1,000 to €10,000 based on five projects	2.2 years
Lighting (LHT)	Light fittings and controls	€1,000 to €19,000 based on seven projects	1.9 years
Building Management Systems (BMS)	Installation or optimisation of BMS	€20,000 to €200,000 based on two projects	1.7 years

Actions identified in one audit only

Heading	Description	Estimated Investment	Estimated payback
Boiler Rationalisation (BOR)	Installation of spray recovery system in the existing flash vessel vent using RO make-up water.	€75,000	3.0 years
Flue Gas Damper (FGD)	Installation of flue gas damper control for the boiler	€10,000	2.9 years
Fuel Switching (FSW)	Switch from light fuel oil to natural gas	€50,000	2.4 years
Compressed Air Rationalisation /Replacement (CAR)	Replacement of compressors, rationalisation of compressor system	€7,000	2.8 years
Chilled Water Plant & Equipment (CHLP)	Inverter controller	€7,200	1.0 years
Chilled Water Rationalisation (CHLR)	Modify circuits & controls of HVAC chiller system	€20,000	1.9 years
Heat Recovery – SRU (HRS)	Heat recovery in solvent recovery unit	€100,000	1.0 years
Process Heat Recovery (PHR)	Heat recovery through integration of process energy use	€100,000	1.0 years
Shut SRU Cooling (SSC)	Shutting solvent recovery unit cooling circuits when not required	€1,000	0.1 years
HVAC Management (HVM)	Optimisation of HVAC Setpoints	€5,000	0.4 years

Actions identified in one audit only

Heading	Description	Estimated Investment	Estimated payback
Replace Air Heaters (RAH)	Replacement of undersized air heaters	€80,000	3.2 years
Water/Waste Water Leaks (WWL)	Recording consumption and detecting leakage	€1,000	2.0 years
Water/Waste Water Management (WWM)	Reducing oxygen set point on WWT blowers	€1,000	0.2 years

II. Final agreements text

C Individual Agreement

For reasons of commercial confidentiality, the individual final agreement text is not included here.

III Analysis of Future Markets and Costs

A. Estimation of Markets and Costs for Full Agreements Framework

Introduction

In order to assess the overall effects of the proposed framework of agreements within the industrial sector as a whole, it is necessary to estimate:

- the full 'market' within the industrial sector for the suggested agreements;
- their potential impacts in terms of CO₂ abatement across the industrial sector.

Using detailed data from the latest available Census of Industrial Production³⁶ (CIP) statistics, made available by the Central Statistics Office, a Pareto Analysis of the whole industrial sector was carried out, with further similar analyses excluding the many small firms unlikely ever to participate in negotiated agreements. Such an analysis was necessary, as industry displays a strong Pareto effect in terms of its use of energy (and hence their energy-related CO₂ emissions; that is, a very small number of firms together account for a very large percentage of overall energy use and related emissions. The details of the estimates made are outlined below.

Estimates of potential markets for each agreement type

Individual agreements

Negotiated agreements tailored to individual firms are only appropriate for very large energy users with unique energy consumption characteristics. All such firms in Ireland may be obliged to participate in emissions trading; thus the role for individual negotiated agreements is not clear. Individual negotiated agreements could have a role during the transition period from 2005 to 2008.

The Pareto analysis showed that nine firms together account for approximately 30% (7,420 GWh) of the total industrial energy consumption, with an average consumption per site of 824 GWh/year. Within that group of nine firms, there is again a strong Pareto effect, with the larger sites within the group accounting for a disproportionate amount of the total consumption for the nine, with the top five conservatively estimated as consuming some 80% of the total for the nine. These estimates indicate that the top five firms together consume some 5,933 GWh/year of energy (thermal plus electrical energy), rounded in the report to 5,900 GWh/year. These top five firms have been selected as potential candidates for individual negotiated agreements.

	Electrical energy	Thermal energy	Total
Overall industrial sector energy consumption (GWh/year):	6,712	18,020	24,732
Top five (GWh/year):	14% x 5,900 = 826	86% x 5,900 = 5,074	5,900
CO ₂ emissions factor (MtCO ₂ /GWh):	0.00077	0.00025	
Top five (Mt CO ₂ /year):	0.64	1.27	1.9

Note: Weighted average emissions factors used – source SEI.

Table A.1 Electrical and thermal energy use, and CO₂ emissions factors – industrial sector overall, and five largest sites

³⁶ Census of Industrial Production 1998, CSO. At the time of writing this is the latest census available that contains a detailed breakdown of Irish industrial energy consumption. The 2001 census data when released will also contain a detailed breakdown of energy use and this will be available for analysis in Q4 2003.

The Pareto analysis indicates a split of 86% / 14% between thermal and electrical energy among very large firms, and this ratio has been used to estimate the thermal and electrical energy consumption for these five firms (see Table A.1). Using the CO₂ emissions factors shown in Table A.1 for estimating CO₂ content of thermal and electrical energy, the total emissions from the top five is estimated as 1.9 Million tonnes CO₂/year.

The pilot individual agreement resulted in a projected saving of 5.4%. If this level of saving were applied to the group of individual agreements proposed above, this would result in overall savings of 0.103 MtCO₂ per annum.

The unique nature of an individual agreement does limit the validity of this simple extrapolation. Most of the savings identified in the individual agreement pilot arise from actions which are highly process specific and which would not apply to any other company. The majority of the savings identified in the collective and technology pilots, on the other hand, arose from non process specific actions which could well be expected to apply to a broad range of companies.

Collective agreements:

It is estimated that some 10 agreements could be put in place, with an average of 15 sites per agreement. It is assumed that these would in the main be large sites. In order to determine the likely size of this group, we have excluded 41 firms³⁷ likely to be involved in emissions trading from the Pareto analysis of industrial energy consumption. The next 150 largest firms are assumed to be the potential group for collective negotiated agreements.

The collective agreement pilot indicated a combined (thermal and electrical) saving of 16% of emissions. Analysing the individual actions, this breaks down into a 14% saving of electricity and a 20% saving of thermal energy related emissions. These figures have been used in the projection in table A.2.

The pilot agreement assumed an 80% rebate of a €17.50 per tonne of CO₂ carbon tax. That equates to an average annual rebate of €230k to each of these 150 firms. This significant financial incentive makes it likely that all of these firms would avail of an opportunity to mitigate the impact of carbon tax. Thus Table A.2 assumes 100% participation in negotiated agreements.

	Electrical energy	Thermal energy	Total
Number of firms in collective agreement	150		
Collective agreement sites (GWh/year):	2,074	3,485	5,559
CO ₂ emissions factor (MtCO ₂ /GWh):	0.00077	0.00025	
Collective agreement sites (Mt CO ₂ /year):	1.60	0.87	2.47
Assumed penetration of collective agreements:	100%		
Assumed impact of collective agreement:	14%	20%	
Projected CO ₂ abatement (Mt/year):	0.224	0.174	0.40

Table A.2 Electrical and thermal energy use, CO₂ emissions factors, and projected impact of agreements – potential collective agreement sites

³⁷ Comprising 26 firms likely to exceed the mandatory 20MW limit for emissions trading plus 10 more large energy users, and 5 moderate energy users who may opt in to emissions trading.

	Electrical energy	Thermal energy	Total
826 potential technology agreement sites (GWh/year):	2,236	3,757	5,993
Assumed penetration of technology agreements	60% of energy (equivalent to 500 sites)		
Estimated energy consumption (500 sites within technology agreements) (GWh/year):	1,342	2,254	3,596
CO ₂ emissions factor: (MtCO ₂ /GWh)	0.00077	0.00025	
Technology agreement sites (Mt CO ₂ /year):	1.03	0.56	1.59
Assumed impact of technology agreements:	14%	17%	
Projected CO ₂ abatement (Mt/year):	0.14	0.10	0.24

Table A.3 Electrical and thermal energy use, CO₂ emissions factors, and project impact of agreements – technology agreement sites

Technology agreements:

Although in theory, technology agreements could be open to firms of any size to join, in practice it is felt unlikely that many sites with an individual annual thermal energy consumption of less than 2.0 GWh would participate³⁸. 2.0 GWh/year, then, represents the lower bound of site size for this estimate. The upper bound is taken to be the smallest site within collective agreements. The Pareto analysis of energy consumption in the industrial sector shows that approximately 800 sites fall within these bounds.

Not all of these will participate in a technology agreement. For the purposes of the estimates here, it is felt that coverage of about 60% of the energy within this group is realistic. This would mean that some 500 sites would participate in technology agreements (either thermal or electrical or both).

Using the parameters described above, Table A.3 shows the estimation of market size and projected abatements in CO₂ arising from technology agreements.

The pilot thermal agreement indicated potential savings of 17% of thermal energy related emissions and this has been used in the projection in Table A.3. In the absence of a pilot electrical agreement, Table A.3 assumes that an electrical negotiated agreement could achieve savings similar to the 14% figure indicated in the pilot collective agreement.

The figures in Tables A.1, A.2 and A.3 rounded, are utilised in the estimates shown in Section 4.5 of the main report.

Notes: ³⁸ 2GWh of thermal energy consumption represents an annual thermal energy bill of about €40k if typical fuel mix is assumed. This is felt to be a realistic lower figure for negotiated agreements, since (a) it represents an annual energy bill that makes participation worthwhile; and (b) the sites participating in the pilot project ranged down in size to approximately 2.5 GWh.

III Analysis of Future Markets and Costs

B. Average Cost of Abatement for a Programme of Negotiated Agreements

Introduction

Negotiated agreements bundle together a package of energy saving actions. In order to judge the cost effectiveness of such a programme it is useful to estimate the average cost of abatement per tonne of CO₂ saved. This calculation includes all costs borne by the state and by the companies involved, netted off against the savings in energy expenditure. Tax and any associated rebate are not considered because these involve no net benefit or cost to the economy as a whole.

Collective Agreement Calculation

For reasons of confidentiality no calculation has been made for the individual agreement. Table B.1 summarises the costs and savings for a national programme of collective agreements. This table is based on the projection given in Table A.2 for a programme of 10 collective agreements covering 150 companies. The annual expenditure includes all set-up, administration and auditing costs, as well as the investment and maintenance costs required to achieve the improvements in efficiency. Investment is assumed to be spread over the four years and the savings rise linearly to 398k tonnes of CO₂ per annum by the end of the period. Costs are discounted at a rate of 10% per annum to reflect the time value of money. The final cost of abatement figure is equal to the annualised cost divided by the average annual CO₂ saving. The resulting average cost is - €8.30/tCO₂ implying that over the four year life of the agreement the savings more than compensate for the costs.

	Year 1	Year 2	Year 3	Year 4	Costs Annualised using a rate of 10%
Annual Expenditure	€13.2M	€12.6M	€14.3M	€17.3M	€14.2M
Annual Savings	€6.8M	€13.6M	€20.5M	€27.3M	€16.2M
Net Annual Cost	€6.4M	- €1.1M	- €6.2M	- €10.0M	- €2.1M
Annual CO ₂ savings (tonnes)	99k	199k	298k	398k	249k
Cost of Abatement					- € 8.30

Table B1. Average Cost of Abatement Calculation for a National Programme of Collective Agreements

Thermal Agreement Calculation

Table B.2 uses the same method to calculate average cost of abatement for a national programme of thermal agreements. It is based on the projection in Table A.3 implying a 60% take-up of technology agreements among the target group of around 800 companies. The higher average level of savings (17% for the thermal agreement as opposed to 16% for the collective agreement) gives rise to an even more negative cost of abatement of - €12.20 / tCO₂.

Summary

The tables above predict a cost per tonne of carbon abated of - €8.30/tCO₂ for a national programme of collective agreements and - €12.20/tCO₂ for a national programme of thermal agreements. The exact values calculated are sensitive to our underlying assumptions about costs and savings. They do show, however, that if the savings found during the pilot agreements are replicated in a nationwide programme, then the savings in energy costs will more than cover the administration and investment costs. These calculations are conservative because they only consider savings that occur during the four-year life of the agreement, but not the savings that will continue to occur after the four years are over.

	Year 1	Year 2	Year 3	Year 4	Costs Annualised using a rate of 10%
Annual Expenditure	€2.7M	€2.5M	€2.8M	€3.3M	€2.8M
Annual Savings	€1.5M	€3.0M	€4.5M	€6.0M	€3.5M
Net Annual Cost	€1.2M	- €0.5M	- €1.7M	- €2.6M	- €730.4k
Annual CO ₂ savings (tonnes)	24k	48k	72k	96k	60k
Cost of Abatement					- €12.20

Table B.2 Average Cost of Abatement Calculation for a National Programme of Thermal Agreements

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