Policies and Measures for Possible Common Action

Progress Report to the fourth session of the Ad Hoc Group on the Berlin Mandate from the Annex I Expert Group on the UNFCCC

1. Background and Introduction

The purpose of this paper is to report on the progress of the project on "Policies and Measures for Common Action" which is being conducted by the Annex I Expert Group on the United Nations Framework Convention on Climate Change (FCCC). The project was initiated in 1994, at the request of the countries listed in Annex I of the Convention. It is supported by the secretariats of the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA). The Group has made regular progress reports on all aspects of this project to the AGBM, recognising from early on that action may have impacts on non-Annex I countries. These briefings also assist with sharing of potentially relevant Annex I country policy experience with non-Annex I countries. This paper reports on preliminary results from the analysis of a range of specific policies and measures.

Section 1 of the paper provides background information on the project including the definition of key terms. Section 2 summarises key themes and issues for policy makers regarding "common action" to mitigate greenhouse gases (GHG). The results reported in Section 2 of this document are preliminary and subject to change later in the light of future work. Section 3 contains summaries from the Tranche I studies conducted under the project. Section 4 outlines insights gained from this first round of work under the project.

1.1 Project objective and approach

The Annex I Expert Group is not a negotiating forum. The objective of the project on "Policies and Measures for Possible Common Action" is to provide an initial assessment of the relative potential of a range of cost-effective policies and measures for future mitigation of greenhouse gas emissions and sink enhancement which could lend themselves to common action. The project is an analytical exercise only and is not intended to prejudge nation's preferences. The project aims to provide background analytical support to Annex I countries[1] in preparing for the Berlin Mandate process of elaborating policies and measures, and for their national climate change strategies pre- and post-2000. It should be emphasised that the selected measures do not represent policy preferences on the part of the participants. The Annex I Expert Group has not formally approved individual Tranche I studies; they are being made available as working papers at the Second Conference of the Parties of the UN FCCC.

The project approach includes three main tasks: defining the scope of the project; developing a framework for analysis; and analysing possible common actions. Elements of each of these are continuing in parallel (see also Annex A). As far as possible, in producing these studies the Annex I Expert Group has solicited the views of non-governmental experts. This was accomplished in several ways despite a very limited time frame, including: a "kick off" workshop to solicit ideas on policies and measures for analysis; the use of non-government authors and experts to make direct contributions to the studies; and, in many countries, an open review process for interim drafts of the studies.

1.2 Definitions for common actions and other terms

In the initial phase of the work a survey of delegations' views on the meaning of "common action" resulted in a range of definitions for the term "common action." Possible or appropriate levels of co-ordination may vary from measure to measure. The following definitions, although not comprehensive, reveal a range of possibilities for common action:

[1] Please note: Every reference to "Annex I countries" in this document is intended to refer to 36 countries and 1 regional economic organisation that are listed in Annex I to the FCCC.

i. specific policies and measures that could be implemented by a group of countries together under some form of agreement to increase the effect of the measures (e.g. trade partners remove subsidies);

ii. co-ordination of action to implement the same or similar measures together (e.g. harmonise standards or test protocols for products);

iii. agreement to take actions in a sector towards a given aim or target leaving the means of reaching the agreed aim to each country (e.g. x% improvement in fuel efficiency);

iv. successful policies and measures that could be replicated in other countries (e.g. countries might choose from a menu of measures).

There are potential advantages and disadvantages to international and to national approaches which need to be assessed on a case by case basis. National level actions may be easier to achieve in a shorter time frame than actions taken collectively. On the other hand, international agreements, including harmonisation, may stimulate action that would otherwise not be possible at national level. In all instances, it is clear that developing any agreement on common action will have to take into account different national circumstances, including differences in cultures of governance, economic and industrial structure and wealth, land use, mobility and building patterns, natural resource endowments, cultural preferences and other social and physical parameters.

The Annex I Expert Group clarified a number of terms at the outset of the project, in order to focus the analysis. While not precluding exploration of alternative policy objectives associated with each measure, the Annex I Expert Group agreed that the project would focus its efforts on policies and measures (see box). With these definitions in mind, the Group developed a framework for the analysis of policies and measures as possible "common actions". The analytical framework, which follows, is intended to function as a guide for the content of each study as well as providing criteria for comparison between the studies:

- policy objectives (GHG and other policy objectives) of the measure
- approach and methodology
- description of the measure, e.g. with differing degrees of commonality
- rationale for common action
- possible participants or vehicles for common action
- GHG emissions reduction potential
- economic effects (costs and benefits)
- political feasibility
- issues for implementation
- time period for implementation
- impact on non participating countries
- conclusion

Prior to selection of measures for study, the Annex I Expert Group conducted a survey of policies and measures being implemented in Annex I countries. Additional suggestions came from a "kick-off" workshop in which a wide range of non-governmental experts participated. Many of the measures from the survey and the workshop were also identified by the UN FCCC secretariat in its report on policies and measures listed in national communications from Annex I Parties (FCCC/AGBM/1995/6). The secretariat report also cited a range of policy objectives as a possible organising principle for action on policies and measures.

In November 1995, the Annex I Expert Group designed two rounds of analysis to cover about 20 of the policies and measures identified in the survey and workshop. The list of policies shown below was initially developed in November 1995 and has been updated to reflect what was carried out under Tranche I and latest discussions on possible future work (Table 1). Tranche I will have been largely completed prior to the second session of the Conference of the Parties (COP-2). Each study is based on a "scoping paper" agreed by the Annex I Expert Group which defines the scope and approach to be used. Future work, including follow up analyses, is being considered for completion prior to COP-3.

Policy objectives: general goals to be achieved by specific government policy interventions or measures; policy objectives guide the development of policies and measures. This study considers a set of policies and measures which have as their objective the reduction of GHG emissions, although they may also have parallel policy objectives that are equally important.

Policies and measures: concrete actions that governments or other government partners can take to influence production and consumption patterns, or more specifically in this case, to reduce GHG emissions. Removing subsidies from coal is an example of such a policy or measure.

Technical measures: measures that refer to specific technologies or processes that will lead to reduced emissions. For example, methane recovery from the agricultural sector is a technical measure that reduces GHG emissions but which can be encouraged through a variety of different policy mechanisms.

Table 1. List of Policies and Measures for Assessment

	Tranche I (near completion)	**Tranche II (possible future work)**
Sustainable Transport Policies	CO_2 Emissions from Road Vehicles	Infrastructure Issues Alternative Fuels Other Issues
Energy Market Reform	Market Barriers/Market Access Full Cost Pricing	Penetration of Renewable, including R&D
Economic/Fiscal Instruments	Reforming Coal and Electricity Subsidies Taxation (i.e. carbon/energy)	Subsidies Reform (continued) Bunker Fuels
Demand-Side Efficiency	Voluntary Agreements (VA) with Industry Energy Efficiency Standards for Traded Products	VA with Electric Utilities (end use) Labelling
Agriculture/Forestry	Identification of Options for Net GHG Reduction	Agriculture (including subsidy reform) (continued) Forestry (continued)
Other	Financing Energy Efficiency in Countries with Economies in Transition	Power System Conversion Efficiency VA with Electric Utilities (Generation) Financing Energy Efficiency in EITs (continued)

2. Tranche I Studies: Preliminary Results

This section highlights main policy themes in the studies, including approaches for common action.

Key Aspects of the Tranche I Study Preliminary Results

The work of this project and of the Annex I Expert Group is analytical and not prescriptive.

Each national government must decide for itself what is right for its own needs and what is appropriate for its own national circumstances.

To the extent that time and available literature allowed, the project considers impacts of alternative options on all countries not simply on Annex I countries.

Consideration of policies and measures as "common actions" by Annex I countries might include:

- further analysis (particularly of national impacts) and sharing of information to build the basis for agreements in key areas (e.g. subsidies reform)
- agreement on areas for "common action" (leaving flexibility on how to take action to participating governments)
- co-ordination of measures and strategies to minimise economic consequences of action

2.1 Scope

The studies (Tranche I and II) consider a range of possible measures and touch on most of the major emitting "sectors" of concern to the climate change debate, targeting both producers and consumers. However, the Tranche I studies are a collection of different kinds of assessment. A few of the studies consider a single measure with a range of different options for design and implementation. Several of the studies cover a range of measures across an entire sector. In addition to considering policies and measures, the studies identify different forms of possible common action, such as agreement on common policy objectives, technical measures and the development of better information or methods to permit policy makers to act together to achieve agreed objectives. They also provide preliminary results on the potential of different types of measure and possible common action to reduce GHG, highlight broad themes for policy development, and suggest specific options, participants and vehicles for action. Finally, many of the studies suggest areas for further work on possible common action by Annex I countries on policies and measures

A number of the studies consider specific types of policies and measures which could be used to mitigate GHG. These include the studies on energy efficiency standards, voluntary agreements, taxation, full cost pricing and subsidies reform in the energy and transport sector. These studies survey a range of issues associated with the design and use of these policy instruments, their effectiveness and costs and in some cases provide case studies on experience in Annex I countries. Voluntary agreements and efficiency standards studies consider specific product- or process-specific emission activities. Taxation, full cost pricing and subsidy reform are economic instruments that cut across sectors in design and implementation. They can be used to pursue emission reductions and to provide long term market signals for GHG reduction.

Some Tranche I studies surveyed a range of policies and measures for mitigation in different sectors (e.g. Transport and Agriculture and Forestry), and in some cases, they also looked at possible policy packages in these sectors. Further, the market reform, full cost pricing and subsidies removal studies, when combined, cover some of the different policy issues in the electricity sector. Finally, a study on financing energy efficiency in countries with economies in transition provides background information on demand

side energy efficiency potential and barriers, and recommends areas for possible common actions for further study.

2.2 National Circumstances and Implementation Issues (including Political Feasibility)

Annex I countries have very different national circumstances for policy making purposes which have to do with social, economic, geographic, and cultural diversity among these countries. For example, the Product Standards study shows that a variety of instruments could (and are) being used to achieve higher energy efficiency, and hence emission reductions, in energy consuming products. A legislated standard is only one of several possible approaches; it is possible to conceive of alternative instruments or packages of measures that could achieve similar results. These might include, voluntary standards, government procurement including incentives; labelling, possibly combined with some form of target setting with the manufacturing sector; or information campaigns. Similarly, the VA study identifies at least four categories of VA and provides examples of these in Annex I countries. Country case studies show that some of the "voluntary agreements" are comparable to regulations as they are legally binding and have strong enforcement clauses. Other "voluntary agreements" are less structured or more open agreements with commercial or industrial partners, leaving full flexibility on how to achieve agreed performance goals. Variation in the style of policy making by country reveals different national circumstances and preferences among governments and their stakeholders. These differences influence how governments choose to approach improved environmental performance and they make it difficult to generalise about the strengths and weaknesses of alternative policy instruments or approaches across any group of countries. Different national circumstances may influence the political feasibility of alternative policies and measures and of possible "common action."

2.3 Packaging of Measures

In the design and implementation of new policy initiatives, policy packages may be more effective than individual measures. For example, many of the measures considered in the Tranche I studies aim to achieve higher levels of energy efficiency through faster development and uptake of economic, clean technology. However, environmental gains from cleaner technology can be offset by increased use or demand for energy using services. For this reason, policies that aim to improve technologies may need to be coupled with those that aim to reduce the overall volume of polluting activity. An example is that product labelling might be coupled with full cost pricing to give consistent market signals to consumers. However the project has only looked at policy packaging in a cursory way. The studies on Subsidies Reform, Full Cost Pricing (including relevant analysis in the Transport study) and Taxation offer some ideas about the packaging of different types of measures as possible common actions. These three studies, taken together, examine a group of policy and market changes that may complement each other:

- Identify and reform existing policies that inhibit the efficient operation of markets and in doing so result in higher GHG emissions than would otherwise occur. Such policies include budgetary subsidies, tax incentives, trade barriers and other measures that promote or protect GHG-emitting activities. This type of policy reform can achieve GHG mitigation while also obtaining other economic advantages. The studies indicate a large mitigation potential from subsidy reform alone.
- Identify environmental and other externalities of energy use and other activities, and internalise them through "externality adders" to energy prices.
- Introduce carbon taxes (or other measures) to internalise the externalities associated with climate change. A carbon tax, or any other policy or measure able to equalise marginal reduction costs across all GHG and sectors, is in principle, the most economically-efficient means of reducing GHG emissions. Case studies have indicated that the cost-effectiveness of carbon taxes, or emissions caps with trading, would be greatly enhanced by prior removal of subsidies and market barriers.

Packaging of measures or groups of measures, such as those above, can potentially provide significant GHG reductions and provide an incentive for change and innovation, leading to more energy-efficient and

environmentally-friendly behaviour and technology, and the market conditions that allow such change to occur. For all of these measures, the studies show that the design of the tool needs to be carefully adapted to local or national situations. They also show that when it comes to implementation, the measure will need to be refined to fit with other measures in the sector. In no study could an identical measure be implemented with equal effect or cost in all Annex I countries. The approach taken to recycling tax revenues or funds saved through subsidy reform will determine the overall social and economic effects of the measures, including the effects on a variety of stakeholders. Packages of measures will need thorough consideration at a national level to ensure that they are politically feasible, and consistent with a broad range of policy objectives. From the standpoint of economic efficiency, market instruments, implemented on a global basis, are widely viewed as preferable to all other options. Issues of equity, competition, trade and leakage effects arise which must be addressed if a country or a group of countries has chosen to implement such a policy, unilaterally or regionally. Barriers to the implementation of these instruments are discussed in the individual studies.

2.4 Sector Results and Strategies

A number of the studies address common action from a sector point of view. While sector target-setting will, in most cases, in fact limit the flexibility and hence the cost-effectiveness of any agreement to limit GHG emissions among a group of countries, a sector by sector assessment of policy options may be quite useful to clarify opportunities for action. Some of the main characteristics concerning emissions performance in each sector are highlighted briefly below by sector along with key sectoral results of the Tranche I studies.

2.4.1 Energy Supply and Transformation Sector

Energy supply and transformation industries are a major source of greenhouse gas emissions in most countries. This sector is made up of a relatively small number of very large players, sometimes government-owned or regulated. Investments in the sector tend to be expensive and long-term, characterised by long lead times for planning and construction of new facilities. Once an investment decision has been made, the technologies and their resulting emissions are locked in for the life of the equipment - from 30 to 50 years. Electricity markets and industries in many Annex I countries are currently undergoing rapid deregulation and liberalisation. The changes provide opportunities for GHG mitigation, but also mean that governments may have to modify the policy levers they use to achieve climate and other policy objectives (see Tranche I study on Market Reform). Policy tools, such as demand-side management or integrated resource planning, will have to be re-examined in this new market environment. New techniques that use or reinforce the market, such as full cost (externality) pricing or subsidy reform, could help to ensure that market reform is consistent with environmental and social objectives as well as achieving economic efficiency objectives (see studies on Subsidies Reform and Full Cost Pricing).

2.4.2 Industry

Private competitive firms are generally expected to be more responsive to market signals than monopolies, public sector companies and consumers. Such firms are usually strongly motivated by “the bottom line” — minimising costs in order to gain market share, and maximising profits for the shareholders. Private industry usually has better access to capital for new investment, and greater expertise in assessing energy-related investment, than smaller consumers in the residential, commercial or transport sectors. This leads to higher uptake of clean and energy-efficient technology where this is cost-effective. Government policies in this sector may affect a relatively small number of decision-makers, especially where those policies focus on energy-intensive industries. This can facilitate the necessary consultation process in the development and acceptance of suitable policy options. Similar to the power sector, however, some industrial facilities have long lifetimes, so that the uptake of cleaner production processes and technologies can be slow. Where GHG mitigation policies encourage industries to retire productive equipment prematurely, this will carry additional economic costs. Additionally, even apparently cost-effective

investments must compete for capital among other, possibly more profitable investment options [see study on Financing Energy Efficiency in Countries With Economies in Transition (EITs.)]

2.4.3 Transportation

The transport sector is the fastest growing source of emissions in Annex I countries with both private car use, road freight and air transport all growing very rapidly. Measures to mitigate greenhouse gas emissions from road transport are among the hardest to implement and monitor. Large infrastructure investments have been made in the past to support road-transport; well entrenched behavioural and cultural factors are difficult to change. Many stakeholders, including freight operators, car manufacturers, airlines and the oil industry, are closely engaged in shaping government action in this sector. Vehicle fleets turn over more rapidly than many other energy-using technologies, so that most of the effects of any change in policies or markets are likely to be seen in on-road vehicle technology within at most 25 years. The Tranche I study on transport evaluates a range of policies to encourage cost-effective technical changes in vehicles. These might achieve some energy-efficiency improvement, but are unlikely to be sufficient to curb the growth in emissions from this sector given the anticipated increase in vehicle use. Indeed, improved vehicle efficiency could result in a further increase in driving. It also considers changes in taxes and subsidies for the use of vehicles, fuels and infrastructure. These might reduce traffic relative to trends along with its negative environmental and social impacts but would still be unlikely to curb the growth in GHG emissions. The study also begins an evaluation, which is proposed to be continued in Tranche II, of measures to promote innovation in transport infrastructure and behaviour. Such measures need to be designed to be highly specific to local settings and national circumstances, but could have a major long term effect on curbing emissions growth from this sector (see study on Sustainable Transport Policies.)

2.4.4 Residential, Commercial and Institutional

The residential, commercial and institutional sector is diverse and has many small players. Emissions from this sector come from a variety of different energy using activities, including:

- general services in buildings (e.g. heating, ventilation, cooling, lighting)
- other services for office dwellers from office equipment (e.g. computers, fax machines, copiers)
- services for residential consumers from electric or gas appliances (e.g. stoves, refrigerators, freezers, washing machines)

Each category of energy use has different technology, institutional and behavioural elements that shape demand. For example, the lifetime of buildings is long (50+ years), whereas the lifetime for appliances and office equipment is much shorter (under 10 years). The difficulties of reducing emissions from this sector are caused by entrenched attitudes towards energy use, lack of information about the cost savings from energy efficiency, market distortions, individuals who do not have the asset backing to make even small investments in efficient appliances in order to make long term gains. Also energy users are not always responsible for the purchase of energy using equipment or building structures, which hinders economic decision-making. Wide variations in settlement patterns and urban development policies can also have a huge influences on national energy and emission trends. Packages of policies and measures could be effective in triggering a range of different kinds of responses. Technology, behavioural change, or less energy/emission intensive urban development, in this sector could have a significant long-term effect and could spread to other sectors.

2.4.5 Agriculture and Forestry

On a global scale it has been estimated that agriculture presently contributes abut 21-25%, 57% and 65-80% of the total anthropogenic emissions of CO2, CH4 and N2O respectively. Overall it accounts for one-fifth of the annual increase in anthropogenic greenhouse gas emissions mostly due to CH4 and N2O. Forests too, are critical components of the climate system: forests contain up to 60-80% of the above-ground, and approximately 40-50% of the below-ground carbon of the terrestrial ecosystems. Noting

these statistics, measures in the forestry and agricultural sectors are considered by Annex I experts to be integral components of a comprehensive program of policies and measures to address climate change. Agricultural emissions result from complex biological and chemical processes and often come from non-point sources. The uncertainty involved in estimating non-energy related agricultural emissions of greenhouse gases is relatively high. The reduction potential of mitigation options to reduce agricultural emissions is therefore highly uncertain. However, many of the options to reduce greenhouse gas emissions from the agricultural sector could be compatible with recent trends in agricultural policy reform such as the promotion of lower inputs and more sustainable systems of agricultural production. These options could also have benefits for other economic and environmental objectives. Similarly climate change objectives, i.e. the conservation and/or sequestration of carbon in biomass, is only one of the objectives of forestry management. Other objectives include sustainable development, industrial wood and fuel production, protection of natural forests and recreation. Nevertheless, the opportunity exists to ensure that carbon management issues have a more prominent role in new initiatives on sustainable forestry and improved best management practice.

3. Highlights of Individual Studies

This section presents brief summaries which highlight the results of individual Tranche I studies. The full texts of all but two of the studies will be released as working papers to be made available at COP-2. The studies on Voluntary Agreements with Industry and Market Barriers/Market Access are on slightly slower tracks; however, it is expected that they also will be released as working papers shortly after COP-2.

3.1 SUSTAINABLE TRANSPORT POLICIES: CO_2 EMISSIONS FROM ROAD VEHICLES[†]

Context

The transport sector is responsible for 25% of global CO2 emissions from fossil fuel use, and this share is growing. Of all energy-using activities, transport is generally the area where governments find it hardest to find politically feasible policies that can mitigate GHG emissions. Projections for Annex I countries indicate that, without new CO2 mitigation measures, road transport CO2 emissions might grow from 2500 million tonnes in 1990 to 3500 to 5100 million tonnes in 2020.

Annex I countries already have in place a wide range of measures that affect vehicle energy use and CO2 emissions. These include vehicle purchase taxes, annual charges, fuel taxes and other fees; fuel economy standards; targets for fuel economy improvement in national vehicle markets; and voluntary agreements with manufacturers to take a range of initiatives to improve fuel economy. National and local governments are also working hard to develop strategies to address the environmental and social problems associated with urban transport, and these strategies can contribute to mitigating CO2 from vehicles. Many countries have announced new initiatives to reduce vehicle CO2 emissions since 1990, including the introduction of all of the types of measures considered in this study.

Description of Measures and their Policy Objectives

The current draft of this study provides an in-depth analysis of several types of measure, which might be considered for implementation in a common action to mitigate road vehicle CO2 emissions:

[†] This paper, and those that are described in the following summaries, represent nine preliminary reports on measures, or groups of measures, considered in the first stage of the project on "Policies and Measures for Common Action", being conducted by the Annex I Expert Group on the UN Framework Convention on Climate Change. The goal of the Common Action Project is to provide a broad assessment of the relative potential of a range of cost-effective policies and measures for Common Action by countries and Parties listed in Annex I to the FCCC, with a view to bringing forward this analysis to the Ad Hoc Group on the Berlin Mandate. It should be emphasised that the selected measures do not represent policy preferences on the part of the participants. The Common Action Project is an analytical exercise only, it is not intended to prejudge nations' preferences on policies and measures.

- Measures whose primary objective is to reduce the energy intensity of cars and "light trucks":
  - "feebates", where purchasers of the most efficient vehicles receive a tax rebate while purchasers of less efficient vehicles pay a tax;
  - "corporate average fuel economy standards" (CAFE);
  - voluntary agreements between governments and car manufacturers to achieve fuel efficiency improvements.
- Taxes on fuels purchased for use in road vehicles. Three options are considered:
  - "vehicle tax reform", where existing charges on cars and light trucks are reduced, and fuel taxes are increased to keep total tax revenue constant;
  - "full budgetary cost pricing", where fuel taxes are modified to improve the extent to which car and truck drivers pay the full costs to the public budget of their driving;
  - "externality adders", where fuel taxes are modified to include externality adders, so that the full social costs of driving are reflected to car and truck drivers.

As well as contributing to CO2 mitigation, these measures might contribute to broader objectives, including reducing the negative social and environmental impacts of road use. Any of these measures might be combined with others, or with additional actions aimed at enhancing their effectiveness by overcoming market imperfections. The measures have been the subject of a considerable amount of experience, debate and analysis. Much of the debate about their effects and costs centres around two key issues: the preferences and behaviour of consumers on the one hand, and the potential for technological developments on the other. The current report attempts to elucidate the range of uncertainty in the costs and effects of these types of measure. The study suggests that further work could address other types of measure, focusing on transport innovation. It also provides a brief consideration of measures that could be addressed in such further work, including:

- local initiatives and packages of measures to reduce the broader environmental and social impacts of transport and, with these, GHG emissions
- research, development, and measures to encourage technological innovation in vehicles, fuels, transport systems and transport and urban infrastructure

Approach and Methodology

For each type of measure, the study aims to evaluate: the potential impact of the measure on vehicle CO2 emissions; the direct and wider economic costs associated with the measure; the other policy issues associated with the measure, including trade, employment, social and environmental issues; issues that need to be considered in the implementation of the measure; the potential advantages and disadvantages of common action to implement the measure; and the possible approaches that Annex I countries might take to implement the measure in common[2].

The analysis of vehicle fuel economy measures and fuel taxes is based on existing literature on the effects of these measures in individual countries, along with additional analysis and modelling to examine the effects on GHG emissions, vehicle ownership and traffic levels in a more general Annex I country context. The study estimates fuel tax increments that might be introduced on a "no-regrets" basis, drawing, inter alia on a set of three OECD country case studies. The costs of vehicle fuel economy measures are estimated based on technology cost-effectiveness studies in the literature. Economic effects of fuel economy measures and fuel taxes are discussed based on reviews of the relevant literature.

Analysis of common action on transport innovation is at a much earlier stage than that of the other measures. The study suggests that further work on this subject might follow an approach based on case studies contributed by countries. The three types differ considerably in the way they are likely to be implemented, the level of government at which they are likely to be implemented, in their potential effects on CO2 emissions, and in the scope for, and advantages and disadvantages from common action.

[2] These are the elements identified for consideration in the Framework for Analysis of the Common Actions project.

GHG Reduction Potential, Costs and Timing, Advantages from Common Action

Light duty passenger vehicle fuel economy standards, feebates and targets[3]

Where there are information or other barriers to the uptake of energy efficient technology in the new car market, the energy savings from this group of measures may be cost-effective for users: some energy-efficiency improvements could be incorporated into cars without damaging other car attributes valued by consumers, and would pay for themselves in fuel savings. The potential for energy savings through such improvements probably lies in the range 5-20% in North America and 10-25% in Europe for new vehicles, if efficient designs are introduced at a rate in line with the normal retooling cycle of the industry[4]. The assessment of the "cost-effective" energy savings level for any standard or other measure is likely to vary among countries, and this type of measure may only be relevant for some groups of countries within the Annex I group.

Energy intensity changes in new cars typically take about ten years to penetrate most of the on-road fleet in OECD countries, but somewhat longer in countries with a high rate of used car imports. In the longer term, the cost-effective reduction relative to trends may be much larger, depending on the adaptability of consumer preferences to new types of car. Measures leading to the uptake of cost-effective technology could have positive effects on consumer surplus and manufacturing employment, although they might also lead to small increases in traffic and its attendant environmental and social impacts. Governments might wish to combine such measures with fuel or vehicle-kilometre taxes to avoid these impacts.

Common action could offer significant advantages for this type of measure, except for countries with very large domestic car markets, as the cost of deploying new technology depends heavily on the size of the market for that technology. Emission reductions that would be cost-effective for vehicle users, from a common action over the Annex I region, could amount to at least 100 million tonnes of CO2, and perhaps several hundred million tonnes. Meanwhile, unilateral actions in this area would be liable to have distorting effects on trade which could be reduced if countries adopted similar measures. The long-run effect would probably be to reduce emissions in non-participating countries, as an increasing proportion of new vehicles would be designed for improved fuel economy. However there is the possibility of a short run effect where less efficient vehicles and, more importantly, designs and production lines, are exported to countries that do not impose the tighter standards.

The majority of new vehicles are subject to one of three types of fuel economy test cycle: that of the European Union and UNECE; that of the United States; and that of Japan. International differences in vehicle markets and driving conditions are often mentioned as an argument against standardisation of fuel economy test cycles. Some types of common action on fuel economy standards might depend on agreement either to use the same cycle or on conversion factors among the cycles. However, agreement on test cycles is probably not necessary for some types of common action on fuel economy, for example, voluntary agreements with manufacturers to achieve fuel economy improvement targets.

Fuel taxation

This section focuses mainly on fuel taxation options which can be considered "no regrets" — that is, their rationale does not depend on climate change policy. The options considered include: "**tax reform**" — shifting the weight of taxation on road-users away from vehicles and towards fuel; "**full budgetary cost pricing**" — ensuring that the costs to governments of road provision are recovered from road users through fuel taxes or other types of charge that reflect the costs associated with particular users; and the augmentation of fuel tax by "**externality adders**" that reflect externalities associated with traffic

[3] "Light trucks" are mentioned here, but the coverage might include a variety of vehicle types, including "vans" or "minibuses", "sports utility vehicles" and four-wheel drive vehicles.

[4] Fuel savings are calculated over 4 years, discounted at an 8% discount rate. In North America, the fuel price is taken to by 30 US¢ per litre of gasoline and the typical car is assumed to be driven 16 400 km per year. In Europe, the fuel price is assumed to be 85 US¢ per litre of gasoline and the average car is assumed to be driven 13 800 km per year.

congestion, accidents, air pollution, noise and other issues. In a very broad-brush analysis, this study estimates that

- "tax reform" from 2000 might reduce light duty vehicle GHG emissions in 2010 by around 10% or more in several OECD countries;
- "full budgetary cost pricing" from 2000 would reduce emissions from light duty vehicles in 2010 by about 5% and emissions from heavy duty vehicles by over 10% in some countries, but in others, no increase in fuel taxes would be justified.
- "externality adders", introduced in 2000, based on externality estimates in France, Japan and the United States, would reduce emissions from all vehicle types in 2010 by 15% or more

These results have an uncertainty of at least ± 50%. In general, most of the effects of tax increases on GHG are nearly immediate, although effects on new vehicle technology can take a decade or more to be fully reflected in the on-road fleet. There is likely to be limited potential to increase the strength of taxes justified on a "no regrets" basis over time, with the exception of "externality adders", where the unit valuation of social and environmental impacts may increase in the future.

The size of the fuel tax increase that might be justified in these three ways is likely to vary considerably among countries, and would have to be decided at a national or perhaps regional level. In view of the variations among countries, it would be hard to justify a harmonised tax level throughout the Annex I group of countries. A harmonised tax at regional level might still be worthy of consideration, given that differences among countries within regions, though substantial, are smaller than those among regions.

Increased fuel taxation is an efficient means to internalise externalities associated with CO2 emissions and fossil fuel resource depletion. Such a tax increase, or a minimum level, might be decided as a common action on an Annex I-wide basis, but would be most efficiently adopted as part of a cross-sectoral carbon tax. The impact on GDP of any net increase in road-user taxation could be positive or negative, and are likely to depend heavily on the way tax revenues are recycled into the economy. This issue would also have to be studied on a national basis to determine the best use for any revenues.

The economic and mitigation advantages of harmonised taxes are uncertain but are probably relatively small, especially where the taxes are justified by costs and externalities that vary among countries. One possible advantage is the reduction in fuel "tourism". Some small countries or countries with long borders do suffer from "gasoline tourism" where car drivers cross the border to seek cheaper fuel, although price adjustments near the border can help avoid this effect. Fuel tankering by trucks is a more serious problem, as trucks can carry enough fuel to drive thousands of kilometres. Where truck drivers carry large amounts of fuel to avoid filling up in countries with high taxes, the result can be an increase in GHG emissions due to the energy needed to carry the fuel.

Fuel tax increases in Annex I countries might affect non-participating countries in various ways. It is not clear whether higher freight costs in participating countries would affect competition, stimulating production (and GHG emissions) in non-participating countries. This effect is not at all well understood, as the role of freight transport in the economy in general is poorly understood. This issue would have to be studied in depth to obtain a clear understanding of possible advantages from tax harmonisation. Higher fuel taxes in Annex I countries might tend to reduce the world oil price which, again, would tend to stimulate activity and GHG emissions in non-participating countries. This effect is not specific to the tax instrument.

Transport Innovation

It is premature at this stage to report in quantitative terms on the possible GHG mitigation effects of "**transport innovation**" measures — these will be evaluated in Tranche 2. The current report identifies a range of measures that might be considered to encourage innovation in transport behaviour, technology and infrastructure.

Measures can be implemented at a local level to change **transport behaviour**, including, for example: reductions in access to roads and parking spaces, and the introduction of fees; reductions in speed limits; "traffic-calming" measures; education and information to change driving behaviour, mode and vehicle choice; encouragement for community-based initiatives. National measures can include legislative provision to allow road pricing by local authorities; introduction of advertising codes of practice for vehicles; media, education, training and information programmes; and support (information, funding, analytical support, etc.) to encourage innovative local initiatives.

Technology and infrastructure innovation might include the development of energy-efficient, alternative fuel or electric vehicles; innovative transport systems; information technology to allow for road pricing and transport control/management systems; new infrastructure designs to encourage non-motorised transport; or low-energy or low-transport intensity goods distribution systems. Innovation might be encouraged through funding of R&D, technology trials, market incentives, information sharing, and other measures.

The effects of innovation are likely to be long-term and are very uncertain. Technology and behaviour changes have the theoretical potential to achieve a near-elimination of GHG emissions from the transport sector. International co-operation in the area of innovation is important to share risk, reduce costs and increase the effectiveness of initiatives. Such co-operation is already occurring to some extent. Common actions in this area might further help to share the costs, risks and benefits associated with experimentation, and provide opportunities for additional exchanges of ideas and experience which would facilitate governments and others in identifying and evaluating new opportunities.

Potential for Common Action

Replication of Successful Measures

The political feasibility of the measures discussed in this study varies strikingly among Annex I regions. Some governments have been able to introduce fuel tax increases at quite substantial rates. Others face strong opposition to fuel taxes from lobbies including oil companies and consumer groups but have been successful in implementing mandatory vehicle fuel economy standards. In the short term, measures in many countries are likely to be feasible only if they are truly "no-regrets" options from the GHG mitigation perspective, although their role in GHG mitigation may add weight to arguments for their introduction. Some of the most obvious "no-regrets" options are: voluntary agreements with car manufacturers for fuel economy improvements at "cost-effective" rates; reforming vehicle and fuel taxation; and encouraging local initiatives to improve transport systems. Attempts to implement even these measures can face substantial barriers, as they may depend on interactions between national, international and local government organisations as well as industry.

Replication might be aided by increased sharing of information about successes and failures, especially regarding different approaches to implementation and working with stakeholders.

Agreement to Take Action in the Transport Sector Toward an Aim or Target

Most Annex I countries might agree that the transport sector represents a priority area for developing new policies to address multiple externalities. However, so far, few countries have made commitments to reduce transport sector emissions separate from those of other sectors. Indeed, many governments would prefer not to adopt such a commitment, considering it more efficient to design mitigation strategies on an economy-wide basis. Nevertheless, Member countries of the European Conference of Ministers of Transport have issued a declaration stating the objective of reducing vehicle CO2 emissions. It is possible that a stronger commitment might be made in the future, among this or another group of countries.

Many countries have established targets for improving the average fuel economy of new vehicles, and several of these targets have been agreed with vehicle manufacturers. This type of target may be more feasible than sector targets as an area for common action, and indeed, manufacturers in the European Union have agreed to such a target on a regional scale.

Co-ordination to Implement the Same or Similar Measures

Experience so far in Europe and North America indicates that it might be very difficult to negotiate common fuel economy standards or harmonised taxes. However, many countries within regions do use similar types of measure — for example, Canada uses US CAFE standards as a voluntary approach, and most European countries have similar levels of fuel tax. Countries have also been able to agree to minimum levels for some types of policy — for example, fuel taxes in the European Union. Some increase in co-ordination is possible taking into account national circumstances, perhaps guided by principles such as full cost pricing, the internalisation of externalities, or addressing information barriers in the new car market.

Specific Policies and Measures Implemented Together

Many of the measures considered here would be inappropriate for harmonised action, as their design depends on local circumstances. To reflect the global costs of climate change, the rationale for common action in the form of a fuel tax "externality adder" may be greater. Such a measure seems some way from implementation, and might depend on agreement to a cross-sectoral carbon tax.

Possible Approaches to Common Action, Participants, and Vehicles for Action

This study identifies some examples of possible approaches to common action which might involve some combination of the various types of measure that have been discussed, and might involve various levels of commonality:

1. **An agreement to take action in the transport sector/replication of successful measures** . Such an agreement might be analogous to existing FCCC commitments with a focus on the transport sector. The monitoring, evaluation and review process associated with the agreement might also be established by analogy with the Convention or might build on work elsewhere. Parties would not necessarily commit to implement specific measures under this agreement but would be free to determine their own most cost-effective approaches. Parties might build on existing efforts in international organisations, such as the European Conference of Ministers of Transport, to establish databases that can be used to monitor the effects of policies and progress in GHG mitigation policy implementation. They might also share information on, and develop methodologies for the estimation of, transport subsidies and externalities.
2. **An agreement to adopt a particular kind of measure** . This might entail agreement to a principle, such as the need to bridge an information gap in the car market, the need for full cost pricing and internalisation of externalities in the transport sector, the need to encourage local initiatives, or the need to accelerate technology development and deployment. Such an agreement could be adopted in conjunction with, or subsequent to, the monitoring, reporting and review option described above. The agreement might also entail a commitment to some specific type of response following from the principles — for example, to introduce a particular type of measure by a given date. This latter type of agreement would probably be most easily implemented on a regional scale, but some types of measure might be agreed throughout Annex I.
3. **An agreement to implement a specific measure in common** . Examples of possible measures include: a minimum CAFE standard or feebate system or an international voluntary agreement with manufacturers; a system of recognition and funding for local mitigation initiatives; or agreed national contributions to a common R&D fund. A common action in this area could build on one or more of the many existing agreements among groups of countries. It would need to be based soundly on expert advice and discussion as well as consultation on policy.

Any of these three types of common action might be established by all Annex I countries or by some sub-set. For individual measures (approach 3), harmonisation may only be feasible on a regional level.

3.2 MARKET BARRIERS/MARKET ACCESS[‡]

The background paper on Market Barriers/Market Access broadly considers the trend toward market liberalisation in both gas and electricity markets. The environmental consequences of liberalisation are complex, case specific and difficult to forecast in a quantitative fashion. It is therefore unlikely that environmental considerations will of themselves be a significant motivation for liberalisation measures, whose objectives lie in a different area. Broadly speaking, liberalisation implies that governments withdraw from the markets, and limit themselves to setting the framework in which companies operate, rather than directly influence market results (prices, qualities and quantities traded, inputs chosen).

The background paper discusses trends in market reforms and the possible consequences for CO2 emissions and describes particular barriers whose removal could be of particular significance. The paper throws light on some of the key issues involved, including the important conclusions that

- perhaps the key consequence of liberalisation is that certain environmental policy instruments may have to be reconsidered;
- the environmental implications of liberalisation can be particularly important when introduced simultaneously with other measures (e.g. the impact of subsidy reform is much quicker and more flexible in a liberalised market);
- the impact of liberalisation on the environment is unclear and will depend on relative changes in the price for different fuels.

The paper therefore suggests the following areas for possible further study:

- the joint effect of reforming fuel subsidies and removing market barriers in power and gas markets (subsidies and externalities are studied separately in other parts of the Common Action project);
- inter-system (regional) liberalisation, e.g. in Europe;
- the CO2 consequences of various ways of dealing with stranded investment;
- possible measures to improve the economics of renewables; and
- the effects of "voluntary" DSM in liberalised energy markets.

These messages from the Tranche I background paper may be reflected in proposals for future work . In more focused studies, attention might be given to the extent to which particular liberalisation measures could act in synergy with the specific policy discussed to produce a quicker and more effective result. This would help gain an optimal focus on climate change issues and realistically achievable common actions.

3.3 FULL COST PRICING[†]

Full cost pricing in the power sector as a possible policy for common action

The series of studies on "policies and measures for possible common action" selected under Tranche I consists of nine studies focusing on different sectors and policy instruments grouped under six different headings. The study on Full Cost Pricing focuses on the power sector and is grouped (together with the study on Market Barriers/Market Access") under the heading Energy Market Reform. It is thus placed at the point where the analysis of measures to reduce greenhouse gases touches upon the wider discussion of increasing market efficiency in the energy sector. It should also be noted in this context that full cost pricing might not, or not primarily, be implemented for reasons of CO2 emissions reductions, but for the reduction of the environmental and human health impacts of local and regional pollutants.

Competitive markets maximise economic welfare if all costs of production are accounted for. Sometimes, however, prices do not include all the costs of production. This holds for sectors with unaccounted for environmental impacts. This leads to inefficiencies, since in the absence of additional measures, private actors do not take these costs into account. In order to eliminate these inefficiencies, instruments have

been designed to include these environmental, or external, costs into private production and consumption decisions. This is referred to as full cost pricing. Full cost pricing thus reflects all resource costs of the final product, be they traded commodities or public resources such as the environment. In other contexts, full cost pricing is also referred to as the "internalisation of external costs."

Typical instruments to internalise external costs are emission fees (full cost adders) or the trading of emission permits. The height of the fee or the price of the permit then reflects the external costs, which, if added to the private cost of production, would achieve "full cost pricing." Full cost pricing, as considered here, has rarely been applied in practice. Instead, emissions control programmes have more often imposed technical abatement measures through regulations or fees set at politically determined levels. These instruments have typically been applied in a manner that significantly reduces emissions, but does not duplicate the effects of full cost pricing.

The power sector has been chosen as a representative example for the potential effects of full cost pricing for three main reasons. First, it is, together with traffic, one of the two sectors in which the most authoritative studies and the most reliable values for hitherto external costs have been generated. Second, not only are these external costs non-negligible, but the regulatory set-up of the power generation industry makes the internalisation of external costs a real possibility. Third, models have been developed in which the power generation sector is represented in sufficient detail to allow to come to at least indicative conclusions.

Consideration of the power sector as a stand alone example of the impacts of full cost pricing also faces some inherent limitations. First, the economic theory that provides the basis for full cost pricing assumes a competitive market. Since the electricity industry is heavily regulated in most countries, the benefits of full cost pricing must be balanced against the possible exacerbation of existing distortions. Second, full cost pricing that does not apply across all fuels can have perverse effects if end-users substitute direct use of primary fuels for purchased electricity. In MARKAL studies, direct competitors therefore have fees imposed to the same degree as the power generation sector.

Policy objective

The objective of full cost pricing is to reduce the emissions of CO2 and other greenhouse gases through the full cost pricing of energy production, transmission and consumption to the extent that local and regional effects on morbidity, mortality, and production are fully included in the final price through appropriate instruments. The full cost values used in this study do not reflect all existing or possible externalities connected with electric power generation. The potential costs of CO2 emissions themselves are not included in this study. Although carbon taxes could in certain interpretations serve as the reflection of implicit perceptions of potential damage costs and thus achieve something akin to full cost pricing for CO2 directly, this argument is not further pursued in this context. The reflection of full costs, for instance through emission fees on pollutants such as particulates, SO2, NOx has an effect on the relationship between inputs and outputs, on the choice of fuels, as well as on the specific technology of production processes. The primary objective is to reduce local and regional impacts. The strength of the impact on CO2 emissions will depend on the degree to which CO2 emissions and the emissions of local and regional pollutants are complementary, or to which degree local and regional pollutants can be reduced without affecting CO2 emissions.

In cases in which the introduction of full cost pricing would lead to overall increases in energy efficiency, or to a general fall in energy demand, the reduction in local pollutants would also unequivocally reduce CO2 emissions. However, in instances where the imposition of full cost pricing would lead to efficiency decreasing abatement measures, such as certain kinds of scrubbers, the imposition of full cost pricing for local pollutants might theoretically increase CO2 emissions.

Approach, methodology and character of the study

The study proceeds on the basis of MARKAL models of three IEA member countries - the Netherlands, Italy and the United States. External costs, based on detailed marginal damage cost assessments for three

local and regional pollutants (particulates, SO2 and NOx) were added to reasonable baseline scenarios reflecting the private costs of production under certain framework conditions. In order to keep with the framework of optimal internalisation, it was assumed that the marginal costs would not vary between the level of production in the baseline scenario and in the full cost scenario. For the Netherlands and Italy, the damage cost values were taken from the "ExternE"-study co-ordinated by the European Commission, whereas for the United States, the, much lower, values were derived from the "Fuel Cycle Study" of the Oak Ridge National Laboratory commissioned by the US Department of Energy.

The main difference between the two studies does not reflect methodological differences, but objective differences in the damages measured. The US study, for instance, is calculated on the basis of lower population densities in the vicinity of newly sited plants than the EC study, reflecting the differing situations in the two regions. The damage values of the US study which are on average an order of magnitude lower than those estimated in the EC study also reflects the role of an existing emissions cap with tradable allowances that already significantly internalises the costs from SO2 emissions. Because of these objective differences, values derived from studies focused on one area cannot be extrapolated to other OECD or Annex I areas where conditions might differ significantly.

The baseline run of the country MARKAL models was compared to a run of the MARKAL models including the damage cost estimate for particulates, SO2 and NOx for all different processes which produce these emissions. In both cases the emissions for particulates, SO2, NOx and CO2 were computed. The difference between the two runs then established the results of the "full cost pricing". The impacts on emissions reported in this study are measured against a hypothetical baseline in which current or planned regulatory, or other, environmental policies are assumed not to exist. The baseline CO2 emissions also deviate to some extent from the projections prepared for the official emission inventories under FCCC reporting requirements. It is important to keep in mind that, as with all kinds of modelling, the results are only roughly indicative of the potential order of magnitude of the actual impact of full cost pricing". Not only is the height of the damage costs open to discussion, although both studies serving as input are of a very high quality, but also the question of the appropriate baseline scenario on which the damage costs are imputed cannot be decided abstractly. The private costs of production, which are reflected in the baseline scenario, are dependent on parameters such as the state of technology, the policy framework and market conditions.

In certain cases, for instance, the policy framework has discouraged the use of a certain cheaper, and more polluting technology in the past, to the extent that its present use is inconceivable. In these cases, it would be unrealistic to use the cost data of this old technology to calculate the private cost of production, as the perception of what a "normal" power plant should look like, and therefore the nature of private costs of production, has changed. Undoubtedly, these are issues of judgement, as it has to be decided case by case whether elements of the policy framework reflect changed boundary conditions, or are already steps toward "full cost pricing" in themselves as which they should be included in the "full cost pricing"-run of the model and not in the baseline scenario. While we would expect the discussion of the study to include this point, one should also keep in mind that agreement is often far easier to reach in the face of concrete, indicative examples than in the abstract.

Results - Impacts of the introduction of full cost pricing in the power sector

Impacts on emissions of local pollutants: As expected, the models showed substantial reductions of up to 70% in the emissions of particulates, SO2 and NOx on which the full cost adders (the marginal damage costs) were levied. These reductions were achieved against a baseline case where existing emissions control policies were discontinued. These results are highly interesting in themselves concerning the effectiveness of environmental policy in the energy sector regarding local and regional pollutants. SO2 and NOx are only indirectly linked to climate change: NOx leads to the formation of tropospheric ozone, a potent greenhouse gas, and sulphate aerosols originating from SO2 have a cooling effect.

Impact on greenhouse gas emissions: The impact of full cost pricing on CO2 emissions reductions was qualitatively established as positive in the context of two case studies of European countries. Using price adders based on the damage values from the EC study, CO2 emissions reductions ranged from less than 1% to 10%, measured against a baseline in which current or planned environmental policies are assumed not to be implemented or are discontinued. It is very conceivable that continuation or reinforcement of these other policies could show equally positive side-effects on future CO2 emission profiles. Moreover, significant variation in damage values across locations, as discussed above, precludes generalisation of the quantitative results to other countries. Impacts on other greenhouse gases were not analysed.

Impact on economic costs: Full cost pricing for local and regional pollutants to the extent that it also reduces CO2 provides an added greenhouse benefit at no additional cost. Nevertheless, economic costs of "full cost pricing" do exist. Full cost pricing that raises electricity prices may increase economic costs caused by existing price distortions in electricity markets. Piece-meal schemes that focus only on electricity may promote welfare-reducing switching to primary fuels by end-users. In general, economic losses of full cost pricing consist of losses of producers and consumers through reductions in electricity demand due to higher prices. The imposition of full cost adders can be viewed as the public good equivalent of prices not levied before for private goods.

There are theoretical reasons to suggest welfare benefits from the imposition of full cost pricing. However, this assessment is sensitive to agreement about the height of externality measurements and the baseline definition. This is due to the fact that the internalisation of external costs reduces inefficiencies and increases total welfare, by reducing negative impacts on health, materials and the environment. Thus, if the full costs are calculated correctly, the losses in producer and consumer surplus and environmental rents are more than offset by the increases in quality of life and the reductions in health and maintenance costs. Thus economic costs of "full cost pricing" come, in principle, at zero total welfare cost (or even benefits), but any existing economic cost has to justified in advance by the verifiable merits of a reduction of particulates, SO2 and NOx alone. Thus total welfare impacts of the complete imposition of correctly calculated full cost adders imputed in a generally accepted baseline scenario should be unambiguously positive.

Linear optimisation models such as MARKAL are unable by their very nature to calculate economic costs, as they always minimise costs subject to a number of external constraints Thus MARKAL results always display zero economic costs and any real world economic cost have to be introduced by means of externally formulated constraints, such as, e.g., adjustment costs, which are then imputed into the model. In terms of the MARKAL model the economic welfare gain can be thought of as the difference between the cost of the externalities and the marginal cost increase in the with externalities MARKAL run, which due to optimisation will always be lower. The imposition of externalities will raise marginal costs of power production, but to a level which is lower than the sum of the old marginal cost plus the cost from the externalities due to the optimising properties of the model.

Other impacts: There are two additional issues which have to be considered. First, the imposition of full cost pricing might have, even in the case of an overall improvement of economic efficiency, distributive impacts which are policy relevant; and second, the imposition of full costs in one country could well make its electricity more expensive in comparison to another country. Concerning the distributional issue, full cost pricing will improve welfare for those, who are particularly exposed to externalities, such as for instance the elderly or the sick, or users of the environment in general at the expense of electricity producers and consumers. On a second level, producers of electricity with lower emissions, such as, e.g., the electricity produced with gas-fired combined-cycle turbines or renewable energy sources will gain at the expense of producers of electricity which is produced with higher emissions, such as, e.g., coal. Concerning international trade issues, the imposition of full cost pricing in one country could, in principle, lead to increased imports of higher emitting electricity from countries without full cost pricing. In practice these effects seem small, except in the case of specific industrial subsectors. Further study might be needed to decide the issue.

Implementation Issues

While full cost pricing is technically feasible, numerous large hurdles remain, including the consensus about the acceptability and validity of damage cost estimates. These damage cost estimates would have to be country or region specific. The issue, whether to adopt "full cost pricing" will invariably be mixed with public policy objectives other than environmental improvement such as security of energy supply, or regional and sectoral stabilisation, or trade and distributional issues. Thus implementation of full cost pricing is a highly complex problem of societal preferences, public choice and policy making.

Rationale for common action and conclusion

Full cost pricing as a common action could help to level the international playing field for the trade of electric power to the extent that it would equally reflect the full cost of production in each country. It would also contribute to the sharing of experiences. To the extent that full cost pricing provides a positive incentive for the development and adoption of emission reducing technologies, a wider introduction would provide a potentially larger market for these technologies. This would offer the possibility to exploit the decreasing costs of a wider production of these technologies. Beyond that, however, there are no intrinsic economies of scale in the implementation of this policy instrument which would make international (or Annex I-wide) adoption of this measure more effective than a country-by-country adoption.

From the standpoint of CO2 emission reductions, the full cost pricing of local and regional emissions of particulates, SO2 and NOx would constitute a costless addition to other measures. However, the benefits from the reduction of local pollutants have to outweigh the costs in terms of economic output. The impacts on CO2 emissions are likely to be small, or negligible at the Annex I level, but regionally they might be more positive. The effects of full cost pricing will differ according to national circumstances, recognising differences in damage values across locations and national environmental policies in the absence of full cost pricing. Adoption of such policies is appropriately based on a determination that their intrinsic benefits in terms of reductions in external costs from targeted emissions outweigh the economic costs. In the end, decisions have to be made taking account not only of the uncertainties connected with externality measurement and modelling, but also of the high number of additional considerations pertinent to the issue.

PLEASE NOTE: A case study of the impact of full cost pricing in the United States power generation sector might still be forthcoming and would be published as an appendix to this study. Current analyses are limited with respect to their implications for individual countries. Additional work now underway, including that in the United States, may help better assess the range of impacts and the range of externality values which reflect the different geographical, demographic and technical circumstances of each country.

3.4 REFORMING COAL AND ELECTRICITY SUBSIDIES

Context

Subsidy reform is one of the major political themes of the 1980s and 1990s. Several OECD countries, from all OECD regions, have taken drastic steps to reassess and reduce subsidies to agriculture, energy, industry and transport. Economic reform has involved an even more comprehensive change in the level and type of subsidies present in central and eastern Europe and the countries of the Commonwealth of Independent States (CIS). Nevertheless, large subsidies remain in place, in OECD and non-OECD countries. Many of these subsidies encourage environmentally damaging activities.

Preliminary indications from studies by the World Bank, the OECD and others, are that, world-wide, subsidies to energy production and consumption amount to hundreds of billions of US dollars, and that removal of these subsidies would result in substantial reductions in CO2 emissions as well as stimulating economic growth. The greatest economic benefits are predicted to accrue to the countries with the largest subsidies — notably, among Annex I countries, those that are among the CIS. The OECD has undertaken a multi-year research project on "Environmental Implications of Energy and Transport Subsidies", to look

at the issue in more detail. The project aims to evaluate the potential for reducing environmental damage, while also achieving economic objectives, through removing subsidies and other types of support to transport activities and energy use. The project, which developed a set of country case studies, is now near completion; preliminary relevant results are reported here.

Description of Measures and their Policy Objectives

The main focus of this paper is on reforming subsidies associated with coal and electricity. Such reform might contribute to meeting the policy objective of reducing GHG emissions. It might also address a range of other economic and environmental policy objectives. The paper emphasises the interactive effect of subsidies and other supports associated with coal and electricity, including policies that were not designed as supports to coal or electricity production. It therefore considers subsidy reform in the context of the reform of a broader set of policies.

Approach and Methodology

This report to the Annex I Expert Group on the Framework Convention on Climate Change (FCCC) draws heavily on the existing case studies from the OECD project mentioned above to evaluate the potential for common action under the FCCC to reduce greenhouse gas (GHG) emissions by removing subsidies. Any assessment of the economic, social and environmental effects of removing subsidies would be incomplete without considering how governments might adjust taxation and expenditure to reallocate any funds formerly associated with those subsidies. This issue has not been thoroughly addressed in the OECD case studies or other existing analysis, and is only superficially considered in this paper, but it is an important area for further research.

Existing literature offers a wide range of definitions of the term "subsidy", depending to a large extent on the reason that subsidies are being examined. While the simplest definition is: "a direct government payment to support the production, sale or purchase of a good or service", this leaves out many types of government intervention that have economic and environmental effects analogous to those of such payments. Broader measures of support, such as the "producer subsidy equivalent" (PSE), include government policies that support the prices producers receive for goods, reduce the costs of their inputs, or that require consumers to purchase their products. In many cases there may be disagreement within a country or among countries as to what constitutes a subsidy to energy production or consumption.

Rather than focus on a single definition of "subsidy", the OECD case studies examine a variety of types of support to energy production and consumption, and use a variety of economic models and assumptions to evaluate the possible effects of removing those supports. An initial study on coal subsidies looked at the effects of removing supports falling under the PSE definition in a number of countries. Subsequent studies on the electricity sector in a number of countries examined a broader range of policies that influence electricity demand, electricity supply industry (ESI) fuel and technology choice, investment decisions, and other factors that might have an environmental effect. A case study on the energy sector in the United States focused on federal supports including grants, tax exemptions and low-interest loans. Finally, a case study on the energy sector in Russia compared the prices of fuels and electricity in 1994 with their estimated opportunity costs, to calculate the implied supports to consumers in the residential and industrial sectors. This range of approaches arose partly by necessity, from constraints on data and resources, and partly by design, in order to explore the value of using different approaches and models.

Role of Subsidy Reform in Meeting GHG Mitigation, Economic and other Policy Objectives

Countries may have many reasons to reform subsidies. Uppermost among these reasons are several economic justifications: 1) it may be that the original policy objective of a subsidy is no longer a priority or that the cost of the subsidy is no longer justified or affordable; 2) the subsidy may cause unwanted distortions in consumption, production or investment decisions; 3) it may be that the subsidy is badly designed, supporting a policy objective through indirect and/or inefficient means; or 4) the subsidy may cause distortions in patterns of trade, leading to objections from trading partners (both other countries and

other competing industries). While these economic concerns have tended to lead the agenda for subsidy reform, environmental benefits have also often formed part of the rationale.

The OECD case studies show that it is not possible to generalise about the environmental and economic effects of removing subsidies, but they do identify particular types and combinations of policies whose removal or reform would probably reduce GHG emissions. For example:

- removing coal producer grants and price supports (including market entry barriers and preferential conditions in ESI regulation and financing): this option appears from the OECD case studies to offer a large potential for GHG mitigation, of the order of hundreds of millions of tonnes of CO_2 per year by 2010 if implemented throughout the Annex I region. Methane emissions are also likely to be reduced.
- removing sales tax exemptions for electricity (and other energy forms): this option appears to offer a small potential for GHG mitigation, less than one million tonnes of CO_2 per year by 2010 in the case studies where the issue was examined
- eliminating ESI obligations and subsidies to supply remote areas: this option appears from the case studies to offer a small potential for GHG mitigation, perhaps in the region of a few million tonnes of CO_2 per year by 2010 in the Annex I region.
- removing electricity subsidies for energy-intensive industries: again, this option appears to offer a small mitigation potential, perhaps in the region of a few million tonnes of CO_2 per year by 2010.

GHG mitigation as a result of reforming these policies is likely to be larger beyond 2010: removing market distortions leads to changes in investment choices by electricity suppliers and consumers, with increasing effects on the generating mix, energy efficiency and GHG emissions. Some of these measures might have advantages from common action — for example, agreement to phase out the provision of subsidies to energy-intensive industry might help to address concerns about competitiveness, making subsidy removal more politically feasible. Removing protection for domestic coal producers and national ESIs in Europe in particular would increase the potential for a continent-wide electricity market. This would provide additional flexibility to exploit the most cost-effective low-GHG-emitting power sources and would enhance the GHG mitigation from removing subsidies. The extent of the potential for this type of reform will be investigated in more depth in further development of the current study, and in the study on Market Barriers/Market Access. Other reforms — such as eliminating subsidies for supplying remote areas, might be in the national interest but would probably not yield substantial additional benefits if adopted as common actions. All of these measures would tend to reduce trade distortions, offering economic benefits and, in the long term, increasing the competitiveness of domestic industry.

The results of the analyses depend on: the methodology used; the range and type of any other policy reforms that are included — in particular where there is a network of policies and institutions that tend to reinforce the effects of the subsidies; the way any reforms are assumed to be implemented; and the way any additional government revenue or reduced government spending is recycled in the economy. Countries will need to carry out their own detailed analysis to determine possible outcomes of different approaches to subsidy removal.

There are many circumstances where removing electricity sector subsidies may have very little effect on GHG emissions. This may apply, for example, to some types of consumer support. Removing other subsidies may increase greenhouse gas emissions. This applies where subsidies to ESI investment are supporting the use of nuclear power, hydroelectric power, off-grid renewables, or energy efficiency investments. There may be cases where removing a subsidy to an energy-intensive industry in one country would lead to a shift in production to other countries with lower costs or environmental standards, resulting in a net increase in global GHG emissions.

Depending on the way supports are reformed, governments may be able to meet their original policy objectives more efficiently than before. Alternative measures, perhaps including different subsidies uncoupled from fossil fuel production and consumption, could achieve the same objectives with lower economic and environmental costs. For example, supports to coal producers and energy intensive industry

are often aimed at maintaining employment in the regions where these industries are located. These subsidies could be converted to local incentives for employment. Residential consumer subsidies are often aimed at ensuring access to electricity for low-income households. These subsidies could be converted to direct grants or subsidies for home insulation and energy-efficient appliances, or income support payments. Rural electrification subsidies are often provided to national monopoly electricity suppliers and can result in grid extensions where stand-alone supplies would have been more cost-effective. These subsidies could be converted to aids for local initiatives to establish renewable supplies and co-generation, encourage energy-efficiency investments or simply to provide income support for rural and remote residents.

Potential for Common Action

Replication of Successful Measures

Many of the benefits from policy reforms can be derived from unilateral action. Before taking action, it can be expected that most governments would wish to carry out their own in-depth analysis to evaluate the extent of their national supports for coal and electricity, and the possible effects of policy reform on GHG emissions and other policy objectives. The political feasibility of subsidy reform may depend strongly on the approach taken to reforms and the explanation provided to, and extent of discussion with, those who have benefited from the subsidies.

Agreement to Take Action Toward an Aim or Target

Differences in national circumstances make it unlikely that countries could agree common, quantitative aims for policy reforms. However, they might be able to consider qualitative aims or benchmarks. Examples might be the aim of reducing budgetary subsidies for electricity consumption, or supports to coal production according to the "PSE" definition. The more general the aim, the more likely it is that a common action might be feasible. Meanwhile, such aims may be espoused as a result of international negotiations to open fuel and electricity markets up to trade.

Co-ordination to Implement the Same or Similar Measures

The feasibility of some reforms, such as reducing the subsidisation of electricity for energy-intensive industry, might be improved through international co-ordination to avoid adverse effects on trade. Indeed, trade concerns have been a major reason for not reducing such subsidies in the past.

Specific Policies and Measures Implemented Together

The differences among countries are such that there are few identical policy reforms that countries would be likely to implement in a harmonised way. However, some reforms may be possible — for example, opening up markets mutually to allow competitive tendering.

Approaches to Common Action, their Rationales, Possible Participants and Vehicles for Action

This report identifies some examples of possible approaches to common action:

a): Replication of Successful Measures

The first approach is an agreement among countries engaged in subsidy reform, or interested in undertaking such processes, (i) to collect, share and monitor information on subsidy removal in their energy sectors. Information might include: descriptions of certain key government interventions in the sector including grants, loans, detailed information on fuel and electricity pricing and taxation, indicators of ESI economic and environmental performance. (ii) to carry out and share analysis of energy policies that tend to increase greenhouse gas emissions, and of the costs of these policies. The reporting process could form part of national communications to the FCCC COP. Based on the results from the case studies, the following pieces of information appear important in attempting to understand whether a country's coal and electricity-related policies are likely to increase GHG emissions:

- the level of direct financial support to coal and electricity production;
- direct financial supports to electricity consumers;
- trade policies for fuels or equipment used in electricity generation or for electricity;

- price regulations and price supports, including controls on procurement of fuels and equipment;
- investment conditions for the ESI.

It might be possible to build on existing databases and experience in the IEA, the OECD and the Energy Charter.

This common action would obviously have no direct effect on subsidies, GHGs or the economy. However, by exchanging information and experience it would enhance countries' ability to assess their own situation objectively. Once countries enter into a commitment to report on their subsidies and to analyse the effects of their removal, there is an increased chance that they will, indeed, remove subsidies where analysis indicates that the results would be beneficial.

b): Agreement to Take Action Towards a Target

The second approach is similar to the first, but includes an agreement among countries engaged in subsidy reform to adopt targets for subsidy reduction according to some agreed metric, or to carry out subsidy reform in a manner that supports the objective of GHG mitigation. The countries would probably be a subset of Annex I countries — indeed, several agreements might be established involving groups of countries with different national circumstances. This could be an initiative through the FCCC, but it might also need to involve other organisations and fora with an interest in this area, including the IEA, Energy Charter, World Trade Organisation and others.

The main advantage of this approach is that it allows countries to make their own decisions about the subsidy reform paths most appropriate for them, and encourages them to carry out in-depth analyses of the options available. The main disadvantages of choosing a target approach rather than picking particular subsidies for removal as a common action are: that the effort countries are making is hard to measure — some countries may need a more specific commitment to galvanise action; and the reduction in trade distortions may be smaller than where countries co-operate on a measure-by-measure basis.

c): Co-ordination to Implement the Same or Similar Measures

The third approach identified here is an agreement among countries to remove certain specific types of subsidy. This might be an extension of Approach (b) to include, for example, a focus on removing coal subsidies or subsidies for electricity consumption by energy-intensive industries. Alternatively it might include an agreement to move from complex means of producer and consumer support towards more specifically targeted direct subsidies.

The three options are not in any way exclusive. Indeed, some countries might prefer the implementation of options (b) or (c) to follow prior implementation of option (a).

3.5 *TAXATION (I.E. CARBON/ENERGY)*[†]

The objective of this study on Taxation (carbon/energy) is to analyse the feasibility of applying such taxation at a common level within Annex I countries drawing from existing experience with taxes implemented to reduce energy-related CO2 emissions, as well as from a range of available modelling and policy studies.

Context

In most OECD countries, almost all forms of energy are taxed to varying degrees, not primarily for greenhouse gas purposes, but to raise government revenues or to internalise other externalities. In fact, there is often an almost inverse relationship between fossil energy price levels, including taxes and subsidies, and their carbon content, i.e., fossil fuels with higher carbon content have lower end-use prices than those with lower carbon content. On a sectoral basis, industrial energy use is generally subject to a low level of taxation, whereas transportation fuels are usually heavily taxed, although with some disparity across countries. There is currently little commonality in the level of final-energy pricing, nor is there any commonality in the energy resources and fuel mixes among Annex I Parties.

Five countries (Denmark, Finland, the Netherlands, Norway and Sweden) have adopted carbon/energy taxes which generally include some rebates or exemptions for industry on competitiveness grounds, or alternative measures to achieve similar objectives. At least two other countries have considered modest carbon/energy taxes (Australia and the US) but those proposals were not accepted. New Zealand has decided that a carbon tax will be introduced in 1997 if emissions are not on track to achieve existing targets, but is also examining alternative approaches such as tradeable permits. The European Union is in the process of considering a proposal for a common carbon/energy tax put forward by the European Commission.

Policy objectives

The principal policy objective of taxing carbon and/or energy is to provide incentives to reduce CO2 emissions, whether through fuel switching, energy conservation, or modal shifts, especially in a context of relatively low energy prices. Taxes on carbon/energy also help reduce other environmental externalities. Studies for specific countries indicate that the secondary benefits achieved through reductions in other environmental impacts could offset part of the social cost of taxes, as estimated in these studies. In some cases, however, countries have already taken independent steps to abate other environmental impacts, therefore secondary benefits may not always be significant. Revenues from carbon/energy taxation can be used to reduce other taxes that are viewed as introducing high distortions on the economy, and help achieve other policy objectives.

Approach and methodology

This study relies on modelling literature (IPCC Working Group III and other specific studies when appropriate), as well as on current carbon and/or energy taxation policies that have been introduced to limit CO2 emissions, including implementation issues, recycling schemes and differentiated sectoral approaches. When possible, lessons are also drawn from pending or rejected proposals for carbon/energy taxation.

A key methodological problem arises from the difference between taxes that have been implemented and modelling approaches to carbon/energy taxation, in particular when looking at common taxation across countries or regions. Implemented taxes are introduced as part of policy packages to reduce energy-related CO2 emissions. These take into account sectoral differences, through differentiated tax levels, exemptions, or subsidies for energy efficiency improvements. Most modelling studies, however, look at a single-level tax as the only instrument to abate emissions.

In studies based on global economic models, the tax should be considered a proxy for the marginal cost of reduction. As such, these studies often provide results that apply to all greenhouse gas reduction strategies: some of their results are not specific to taxation as a tool to reduce emissions. In theory, any difference in marginal costs of reduction across regions entails that similar reductions can be achieved in a more economically efficient fashion by equalising the marginal cost of reduction, represented by a common tax. It isn't at all clear that cost and greenhouse gas potential estimates from such studies can be used to compare unilateral and common actions, given the complexity of real taxation schemes, as illustrated by current experience.

Furthermore, studies of unilateral taxation fail to describe what actions are taken by other Annex I Parties to limit their emissions. This and the previous points lead to the conclusion that it is not possible to provide a full quantified comparison of unilateral versus common taxation. Last but not least, this study does not address issues related to equity, a potentially key element in the design of and agreement on common carbon/energy taxation.

Description of measure(s)

The study looks at taxes based on the carbon and/or energy content of different fuels, from carbon taxes to energy taxes. As an illustration, restructuring existing energy taxes applied to all fossil fuels, based on their carbon/energy content would contribute significant CO2 reductions. This, however, is not a straightforward option, since existing taxes have been introduced for (fiscal, environmental and other)

purposes that cannot be discarded. The schemes adopted for recycling tax revenues are crucial for the analysis of the economic impacts of carbon/energy taxes. Among others, the study looks at the opportunity of using tax revenues to finance carbon/energy efficiency improvements in sectors where the increase in energy expenditures would be most damaging, e.g. due to rigidities in the capital stock. It also touches on the possibility of coupling carbon taxation with carbon sequestration.

Different national circumstances, e.g. with respect to the level of economic development, the availability of energy resources and end-use energy prices, are potential barriers to implementation of a single carbon/energy tax as a measure for common action at the moment. A less ambitious suggestion would be to agree on pricing as an instrument to reduce energy-related CO2 emissions in the long run, such as an agreement to keep domestic fossil fuel/energy prices from declining in real terms. However, further analysis would be needed to look at implementation issues related to such an option.

Rationale for common action

The rationale for common action is based on theoretical and empirical analyses which find that a more cost-effective outcome in aggregate economic terms would be obtained if all participating countries would equalise their marginal cost of reduction, represented by a tax in modelling studies. An agreement to introduce price signals on carbon/energy would make such policy more effective than if it were adopted unilaterally. It may also help avoid establishing complex border tax adjustments between participating countries, although border tax adjustments might still have to be implemented for trade with other regions (pending their being legally and technically feasible). A widely-agreed price signal on CO2 emissions could create a significant market for lower-carbon technologies. This could result in cost reductions for such technologies, through economies of scale enabled by sales on a larger market than in the case of unilateral action, without picking "winners and losers".

In practice, a number of implementation issues stand in the way of adopting a common taxation, starting with sectoral differences within countries, and different levels in energy pricing (see the experience of the carbon/energy tax proposed by the European Commission). When common taxation is considered, a flexible approach, e.g. relying on phased-in price increases, or a broad agreement on the need to reflect the cost of climate change in energy prices, may alleviate some implementation problems at the national level (e.g., the need for exemptions on competitiveness grounds).

Possible participants and vehicles for action

The question of possible adoption of carbon/energy taxes either at national or some common level among Annex I Parties must be addressed on the background of current energy policies. Countries with economies in transition are still trying to reduce subsidies and achieve pricing at marginal production cost for all end-use sectors. Raising prices to cover production costs should already contribute to reducing energy-related CO2 emissions. Real carbon/energy taxes, to be applied on top of the marginal cost of production, are not likely to be a priority for those countries before marginal cost pricing is achieved, i.e., subsidies are removed.

Greenhouse gas reduction potential

General modelling results

Modelling studies typically evaluate the impact of reaching different limitation and reduction objectives through the use of carbon and/or energy taxation. These target-based studies suggest that the potential for abating CO2 emissions from energy use through carbon/energy taxation is in general high in the long term. Modelling results confirm the economic intuition that CO2 emission reductions are obtained more effectively with carbon taxation than with carbon/energy or energy taxation. These results are produced under specific assumptions, such as optimising behaviour by all agents in the economy.

Price instruments, if applied coherently over the long-run, do provide a signal to abate the energy intensity of production and consumption. It can be said that current modelling approaches tend to underestimate the adaptive behaviour of producers and consumers over the long run in response to steady changes in price signals, because global economic models underestimate the technology innovative responses, and

phenomena such as economies of scale and learning curves, which could increase the reduction potential of a given tax level.

Economic and technology-based models both indicate that the marginal reduction cost to achieve a similar reduction objective would vary across countries, a conclusion that is consistent with different national circumstances. Because of differences in marginal cost of reduction, global economic models arrive at the conclusion that equalising marginal reduction costs, e.g. through a common tax level, would minimise the aggregate GDP cost, or that a higher reduction potential could be achieved at the same overall GDP cost. Again, this conclusion illustrates a general economic principle that applies to all policies and measures able to equalise marginal reduction costs across all greenhouse gases and sectors.

Results for the short and medium term indicate that energy users would respond to a price signal over time by reducing emissions, although simple utility and production functions do not adequately render the existing rigidities of certain demand categories, or the lead time necessary for adjustment. Energy use in transportation, already highly taxed for fiscal reasons in most Annex I countries, would not respond significantly without the introduction of new technologies and changes in infrastructure, since alternative means of delivering mobility or fuelling most transport modes are not readily available. This suggests the need for progressive introduction of taxes, instead of a strong signal at the outset. In general, given shortcomings inherent in model-based analyses, results included in this study are mainly indicative of some of the effects of carbon/energy taxes on the overall economy.

Carbon leakage

Carbon leakage takes place when reduction strategies pursued in one region entail an increase in emissions in another region. The IPCC Second Assessment Report suggests that estimates of leakage range from negligible to almost 100%, for some specific activities. Carbon leakages can take place through two channels: the loss of comparative advantage from adopting a tax, resulting in increased production of energy-intensive goods elsewhere, and the effect of lower demand for fossil fuels on world energy markets.

As for the effects on comparative advantage, if there were a common action to introduce price signals, there would be less opportunity to re-locate production in a country with similar levels of economic development. For countries trading mostly outside Annex I, however, emission reductions achieved at home may be offset by an increase in emissions outside the region. Although energy expenditures amount to a relatively low percentage of GDP within OECD economies (between three and 11 % on a purchasing power parity basis, with a 5.8% average for OECD as a whole), energy-intensive industries would still lose competitiveness, all other things being equal, if other trade partners were not to adopt similar carbon/energy taxes.

With regards to energy markets, it can be argued that common action to reduce energy-related emissions within Annex I, if not achieved through absorption or carbon removal, will entail a decrease in global energy demand, lower international prices and spur emissions outside the region. However, this effect is not specific to a tax. A similar drop in energy price will occur whatever policies and measures are used to obtain similar energy-related CO2 reductions, insofar as they reduce the demand for tradable fossil-fuel based energy.

Economic effects (costs and benefits)

For the most part, economic effects of carbon/energy taxation are derived from macro-economic modelling approaches. As mentioned in the section on “approach and methodology”, a number of limitations apply to such modelling results. Among others, these models can only confirm the theoretical economic superiority of a single price signal to achieve an overall reduction objective within a group of countries, compared with unilateral taxation policies to achieve such reductions on a country-by-country basis. In that respect, this study does not shed any new light on the economic benefits of using a common price signal.

Short-term economic impacts are assessed with so-called macro-econometric models, which account for unemployment and other market disequilibria. Longer-run economic impacts are generally estimated with computable general equilibrium models, assuming that all markets operate efficiently. These economic models, in general, do not account for sectoral differences, especially with respect to the degree of elasticity in response to price signals over different time frames.

Another shortcoming of most macro-economic analyses is that they do not take into account a "no-regrets" potential and existing market barriers to energy efficiency improvements. A tax would provide a powerful signal for more cost-effective energy choices. In that respect, computable general equilibrium models probably overestimate the cost impacts of carbon/energy taxation. On the other hand, the assumption of cost-minimising behaviour in such models may exaggerate the adaptability of economic agents in responding to changes in energy prices.

According to many of these models, as summarised in IPCC, the aggregate economic cost of stabilisation at current levels in two decades would be in the order of magnitude of 1% of gross domestic product in the final year[5], with potentially significant differences across countries. These same modelling results also suggest that such differences in GDP losses could be reduced by equalising marginal reduction cost, for example with a common price signal.

Distribution issues

In introducing a new carbon/energy tax, distribution issues constitute a principal bone of contention. Absent massive CO2 offset options, a tax on carbon/energy would particularly affect the fossil fuel sector as well as energy intensive industries. It is important to note that any policy aimed at reducing fossil fuel consumption would have a similar effect on the energy extraction and refining industry. Still, experience shows that the point where the tax is applied (at the mine mouth or at the utility busbar) affects the perception of costs among agents, and their support or opposition to the tax. In terms of effects on different income groups, a carbon/energy tax, absent any compensating measures, could be regressive, with differences across countries coming from, among others, the reliance on personal vehicles, and the total energy mix in households energy consumption. Tax policies can be adapted to offset the regressivity of a carbon/energy tax.

Recycling options

National experiences with new carbon/energy taxes show practical ways to recycle tax revenues to alleviate the more negative effects of the tax on low-income groups. In most cases, the carbon/energy taxes have been introduced as part of a fiscal reform, aiming to lower taxes on capital and labour, while reducing energy-related externalities. Modelling studies focused on short to medium term effects show that a low carbon tax, if properly recycled to reduce more distortionary existing taxes may result in a net macro-economic gain, i.e., an economic dividend in addition to the environmental dividend. Employer's paid social security contributions could be reduced to foster employment; the tax can also be recycled into investment tax credits, with positive effects on GDP, or to reduce government deficit.

There is not, however, a consensus on the existence of a double-dividend. For instance, macro-economic models accounting for unemployment find that recycling tax revenues through lower employers' paid social security contributions could offset the negative effect of the tax on GDP, through higher employment. Computable general equilibrium models which generally ignore unemployment find that recycling carbon/energy tax revenues would not offset the distortionary impact of a carbon/energy tax.

Carbon/energy tax revenues can be used to finance energy-efficiency improvements in an interim period, an option currently implemented in some European countries. Such measures contribute to minimise the increase in energy costs for energy-intensive activities, through a lowering of their carbon-intensity. Funding of research and development for low carbon/energy technologies could also be envisioned. If not

[5] GDP effects are expressed as a percentage reduction from the baseline for a given year, or as the present value of real income changes over the simulation period, relative to baseline levels.

introduced temporarily, such policies ought to be carefully monitored to ensure that they do not introduce permanent distortions in energy choices.

Carbon sequestration as a joint-policy tool

This study briefly explores the possibility of offering a choice between paying a carbon tax or sequestering carbon through afforestation measures, when sequestration can be achieved at a lower cost per avoided ton of CO2. Another option would be to use forestry measures to enhance the effectiveness of a carbon tax, through the recycling of tax revenues as an incentive payment for carbon sequestering. Such schemes would introduce some additional complexity; they would require further analysis especially if they are to be considered as an instrument to be used in conjunction with common taxation.

Feasibility

Any taxation scheme agreed at some international level would have to deal with most implementation issues experienced in setting carbon/energy taxation at the national level. Experience shows that even "modest" homogeneous taxes on carbon and energy may be difficult to introduce in some Annex I countries, even when exemptions are granted, and other economic policy objectives could be obtained with the tax. The cost of an increase in taxation, directly perceptible by economic agents, does trigger significant political opposition, but this is not unique for taxation instruments. Exemptions for exporting industries, differentiated tax rates across agents, phased-in taxes and various recycling options are possible instruments to overcome some of the political barriers to taxation at the country-level, although they may lower the efficiency of the tax. On the other hand, the relative effectiveness of cross-cutting instruments, such as taxation, may help to overcome implementation obstacles.

In general, barriers to the implementation of a single uniform tax stem from national differences in energy mix and pricing, from sectoral differences in energy-use, and from distribution issues. End-uses such as transportation where taxes are already high in most countries, could absorb a modest price increase from a carbon/energy tax in those countries. Other sectors like industry and power generation are constrained in the near term by the lifetime of their physical capital. Different tax levels across activities and users, where risks of tax evasion were low, have been used in some instances. The progressive introduction of carbon/energy taxes, and a clear schedule for their evolution over time would help minimise the cost of reducing long-term CO2 emissions. In some cases, existing taxes were replaced by taxes based on the carbon/energy content of the fuel, and increased on that basis afterwards.

A common approach to taxation might help reduce the opposition to a tax on competitiveness grounds. However, this is not the case for all Annex I countries, because not all Annex I countries primarily trade with other Annex I countries. For that matter, changes in competitiveness would not be similar for all Annex I countries. This issue is linked to the deliberations of the World Trade Organisation on the possibility to introduce border tax adjustments on embodied carbon and energy[6], as well as on the practicality and effectiveness of such adjustments.

The ongoing discussion within the European Union on proposals by the European Commission for a EU-wide carbon/energy tax shows the difficulty of obtaining an agreement on common taxation, also when significant flexibility for member States to reach a uniform tax level in the future is provided. In addition to domestic implementation issues, countries may be reluctant to introduce a tax at a rate that will be set at some international level, which would take away their control over revenues of the common tax. The European Union member States agreed to follow the approach of using minimum levels of excise duties, which is already in place for mineral oils, to overcome this problem. In practice, questions such as the exchange rates to be used for translating the common tax, the rules for its evolution given differences in exchange rates, inflation, and reduction levels achieved in participating countries, would require careful attention for the tax to be able to provide a steady price signal for energy choices. The question whether to levy a carbon/energy tax at the level of producers or consumers will also require careful attention.

[6] The Committee on Trade and the Environment of the World Trade Organisation is expected to address this issue before December 1996.

Time period

The purpose of a carbon/energy tax is to provide a steady price signal over time, so as to move away from carbon-intensive energy choices. Such a price-driven shift can only happen in the medium to long-term, due to the rate of capital stock turnover and existing infrastructures. This explains why in most cases, carbon/energy taxes are used as one instrument in a much broader package of policies aimed at reducing greenhouse gas emissions. Taxes could be designed so as to best exploit different lifetime of capital stocks across sectors, e.g. through taxes that are phased-in at different rates. This would minimise the transitional costs of a tax. Any early retirement of existing equipment, which may be necessary to achieve national targets for reductions, comes with an opportunity cost. Providing temporary subsidies for energy efficiency improvements, e.g. through recycling of tax revenues, would help reduce such opportunity costs.

Impacts on other countries

Two issues could be considered: leakages (positive and negative) and border tax adjustments.

Leakages

Any reduction in fossil fuel demand to reduce CO2 emissions in Annex I would entail a decrease in international prices of carbon-based fuels, beneficial to the rest of the world as a whole; carbon/energy taxation would also have that effect. Moreover, countries competing internationally with industries from countries with carbon/energy taxes would be granted a competitive advantage from their un-taxed energy, and become more attractive for investment in energy-intensive activities. On the other hand, they might pay a higher price for imported goods from Annex I countries implementing the tax, and be affected by other changes in their terms of trade. Modelling analyses disagree on the overall impact on non-participating countries and on their emissions. While their energy use and emissions may increase, their economic growth may be affected positively or negatively (lower exports to Annex I countries, due to lower demand for fossil energy and possibly slower economic growth). Even the general direction of changes is uncertain, given the different assumptions on terms of trade, trade balances and the substitutability between domestic and imported goods.

Another aspect of leakages that is not studied in the literature is the possibility for non-participating countries to benefit from technological developments taking place in those countries implementing a carbon/energy tax. In the longer run, this spillover effect may help non-participating countries to reduce their energy-related CO2 emissions (not to mention to have more efficient, competitive industries and economic infrastructure).

Border tax adjustments

In addition to the taxation of fossil fuel and other energy imports, which is common practice, Annex I countries implementing carbon/energy taxes could decide to introduce border tax adjustments on their imports and exports, related to the embodied carbon/energy, to and from non-participating countries. This has not been the case so far, although it was included in the BTU tax proposal of the United States. The World Trade Organisation has yet to provide a definitive answer on this question. If participating countries were to tax imports from non-participating countries to assure fair competition on their domestic market, they would affect the export revenues of non-participating countries. A careful analysis of embodied carbon in imports from non-participating countries would be necessary to obtain an order of magnitude for the effect of a border tax adjustment on imports. The administrative requirements and technical practicality of border tax adjustments may be the greatest barriers to their implementation.

3.6 VOLUNTARY AGREEMENTS IN INDUSTRY: STATUS REPORT†

Voluntary agreements are increasingly prominent in many Annex I countries as a flexible tool for achieving improvements in energy efficiency and reduction in greenhouse gas emissions. Voluntary agreements, vary considerably in their form and structure from country to country and industry to industry.

They range, for example, from non-binding VAs for industry in relation to specific actions, to Vas that establish legally enforceable targets. An environmental VA may broadly be defined as:

> *An agreement between government and industry to facilitate voluntary action with a desirable social outcome, which is encouraged by the government, to be undertaken by the participant based on the participant's self interest.*

By this definition, actions that are undertaken without government initiative (or initiative of non-governmental bodies) or are undertaken solely by government mandate are not VAs.

One can identify several characteristics that differentiate VAs. These include: the manner of target or goal setting, the nature of participant commitment, the degree of regulatory (or fiscal) threat, and the mix of VA participation incentives. Within each of these dimensions a range of options are possible. Four major types of VA policies or programs are identified in this report:

- Target-Based VA
- Performance-Based VAs
- Co-operative R&D VAs
- Monitoring and Reporting VAs.

A background study on voluntary agreements in industry is currently near completion and will be made available shortly after COP2. In the short time available a full assessment of framework issues was not possible. This study sets the stage to allow assessment of specific voluntary agreements foreseen in possible future work on the project (e.g. voluntary agreements with electric utilities on both demand and supply side issues). This background study contains several elements, including:

- a proposed framework for assessing voluntary agreements, including definitions and different categories of voluntary agreements. The proposed framework also suggests an approach to assessing the performance of voluntary agreements.
- a series of case studies of the experience of Annex I countries with the implementation of VAs by energy intensive industries. A description of the characteristics of VA is provided and where possible information concerning costs, and performance evaluation.
- analysis, drawing on the case studies, of the main characteristics of VA, issues for successful implementation, and a discussion of the possibilities presented by VAs for common action, including some of the possible barriers to successful implementation (e.g. free riders, competitiveness concerns, and how to ensure co-ordination with other regulatory measures).
- some specific information on the three industrial sectors which were identified for study (iron and steel, aluminium and adipic acid manufacturing). This includes trends in production, and the cost-effective potential for reducing greenhouse gas emissions within these sectors.
- an initial assessment of voluntary agreements as possible common action.

As part of the analysis, the study suggests some possible forms of common action, ranging from an agreement on international co-operation for information sharing, to common action to pursue a certain type of VA:

- Dissemination of national experience with VAs with recognition that such actions can be a legitimate mechanism for implementing commitments.
- An umbrella action to exchange information on successful VAs and to develop methodological and analytical frameworks to assess performance, effectiveness and progress of different types of VAs. An expert Group could be set up to develop guidelines and methodology.
- A general agreement to implement VAs with countries retaining the freedom to develop and implement the type of VAs most suited to their economic, political, cultural and regulatory context.
- A group of countries could agree to start negotiating with their own industries on energy efficiency targets or performance goals, to be achieved over a given time frame.

- A similar approach could be envisaged at the sectoral level, under some international authority: companies of an industry with operations in different countries, including multinationals, would be the participants to such a scheme. Individual companies could agree to work to achieve international energy efficiency reduction targets for their industry, without direct involvement of their governments.
- A group of countries pursuing similar types of VAs with similar goals agree to work towards harmonising their VA.
- International voluntary standard setting.

3.7 DEMAND SIDE EFFICIENCY: ENERGY EFFICIENCY STANDARDS FOR TRADED PRODUCTS†

Full description of measure:

This report examines energy efficiency performance standards for Annex I countries on refrigerators/freezers and office equipment, which were chosen as representative examples for analysis.

Context:

Energy efficiency standards and labelling schemes for appliances and equipment are playing an increasingly important role in Annex I Parties' strategies to meet their energy and environmental policy goals. Refrigeration is typically the largest domestic sector electricity end-use (about 20% of domestic electricity consumption) and offers large potential for further improvements in energy efficiency. At present there is a clear distinction between the type of refrigerators available in different regional markets and most companies have shown little interest in selling the same models on different regional markets. However, there is a tendency toward greater inter-regional component sourcing and transfer of technology and at least two refrigerator manufacturers have already developed into trans-global concerns.

Office equipment consumes nearly 80 TWh/year of electricity in OECD countries. The largest energy end uses in the commercial sector are space conditioning and lighting, but office equipment is the fastest-growing electrical load in the commercial sector and may already represent 5% to 20% of commercial electricity consumption. Unlike refrigerators, the product characteristics and energy efficiency of office equipment are quite similar in all countries because the market for office equipment is world-wide. In both the residential and commercial sectors, the potential for CO2 reductions from saving a unit of electricity varies widely among different Annex I countries, because of variations in the amount of carbon based fuel such as coal, oil or natural gas that is used to produce electricity.

Policy objectives: Common action on product standards could contribute to a range of policy objectives, including increasing the energy efficiency of products, reducing the associated greenhouse gases (assuming fossil-fuels are used to produce electricity to operate the products), facilitating trade between countries with the same or similar levels of standard, and increasing consumers' disposable income by reducing energy costs.

Approach and methodology:

Regional scenarios were developed using spreadsheet models to assess the greenhouse gas reduction effects of implementing the same energy efficiency standards for refrigerator/freezers and office equipment in different Annex I regions. The results are derived from analysts' best judgement on the value of key parameters, which in some cases greatly notably the autonomous energy efficiency assumption. These scenarios assume for the sake of analysis affect the results - that mandatory minimum energy performance standards (MEPS) are implemented by all Annex I countries. Other sections of the report discuss a broader range of implementation options, based on information available from published and unpublished literature.

Rationale for common action: The main rationales for common action on product standards are: a potential reduction in trade distortions between countries adopting the standards; wider availability of

cheaper and more efficient products through larger product runs; and, possibly, bigger reductions in greenhouse gas emissions through some form of common action than would otherwise be possible if countries acted alone.

Possible participants and vehicles for action:

The implementation of product standards is most likely to occur at national level regardless of the form of common action that might be agreed at Annex I level. Participants for action on product standards at national level could include governments; manufacturers; and consumer groups. Possible vehicles for action are: Legislatures or Parliaments, government departments; national standardisation bodies; industry associations; or individual industry representatives.

Possible participants at the regional level are: European Union (EU) countries, North America Free Trade Agreement (NAFTA) countries, Asia Pacific Economic Co-operation (APEC) countries, multinational industries; and industry associations. The main non-governmental international standardisation bodies the International Standardisation Organisation (ISO) and the International Electotechical Commission (IEC) would be important participants and vehicles for action. Other possible vehicles for action could be the International Energy Agency (for example through implementing agreements), the Organisation for Economic Co-operation and Development (for co-ordination and analysis), and the European Commission.

Greenhouse gas emissions reduction potential:

For refrigerators/freezers, the basecase scenario results show that for most Annex I regions, there would be some basecase improvements in energy efficiency, through new stock replacing the old and through efficiency improvements to the products. However, for North America and Australia/NZ, population growth begins to outweigh efficiency improvements towards the end of the scenario period, and for eastern Europe more people are expected to buy more energy intensive fridges as income rises[7]. Assumptions about future composition of the appliance stock are an uncertainty in the analysis. Most of the scenarios assume that consumers will not buy larger refrigerators or more energy intensive frost-free models with the money they save from more efficient appliances. The analyses for central and eastern Europe assume a gradual change in the type of appliance demanded is assumed as income rises.

The "introductory standard" scenario (equivalent to the EU proposed standards), has a small effect on CO2 emissions overall (4.5% reduction from basecase in 2020), but no effect in North America where standards are already more stringent than this level, and negligible effect in Japan. The "more rigorous" scenario (equivalent to the proposed US NAECA 1998 standards) has a large effect in all regions (25% reduction from basecase in 2020). The results show different effects from the same standards in different regions, because of differences in product attributes that influence energy use and product lifetimes, different population growth forecasts, differences in the mix of fuels used to produce electricity, and different starting levels of product energy efficiency. These results are indicative only, as the scenario analysis can in many cases only guess at future developments in key variables such as energy prices and assumes no fundamental technological changes take place. The scenario analysis cannot provide insights on the extent to which harmonised action by Annex I countries might achieve greater (or lesser) benefits than national action.

[7] The preliminary results presented in Figure 1 for Australia and New Zealand are indicative only and have not been fully reviewed owing to delays in receiving the case study for this region.

FIGURE1: REGIONAL EMISSIONS FROM REFRIGERATOR FREEZERS

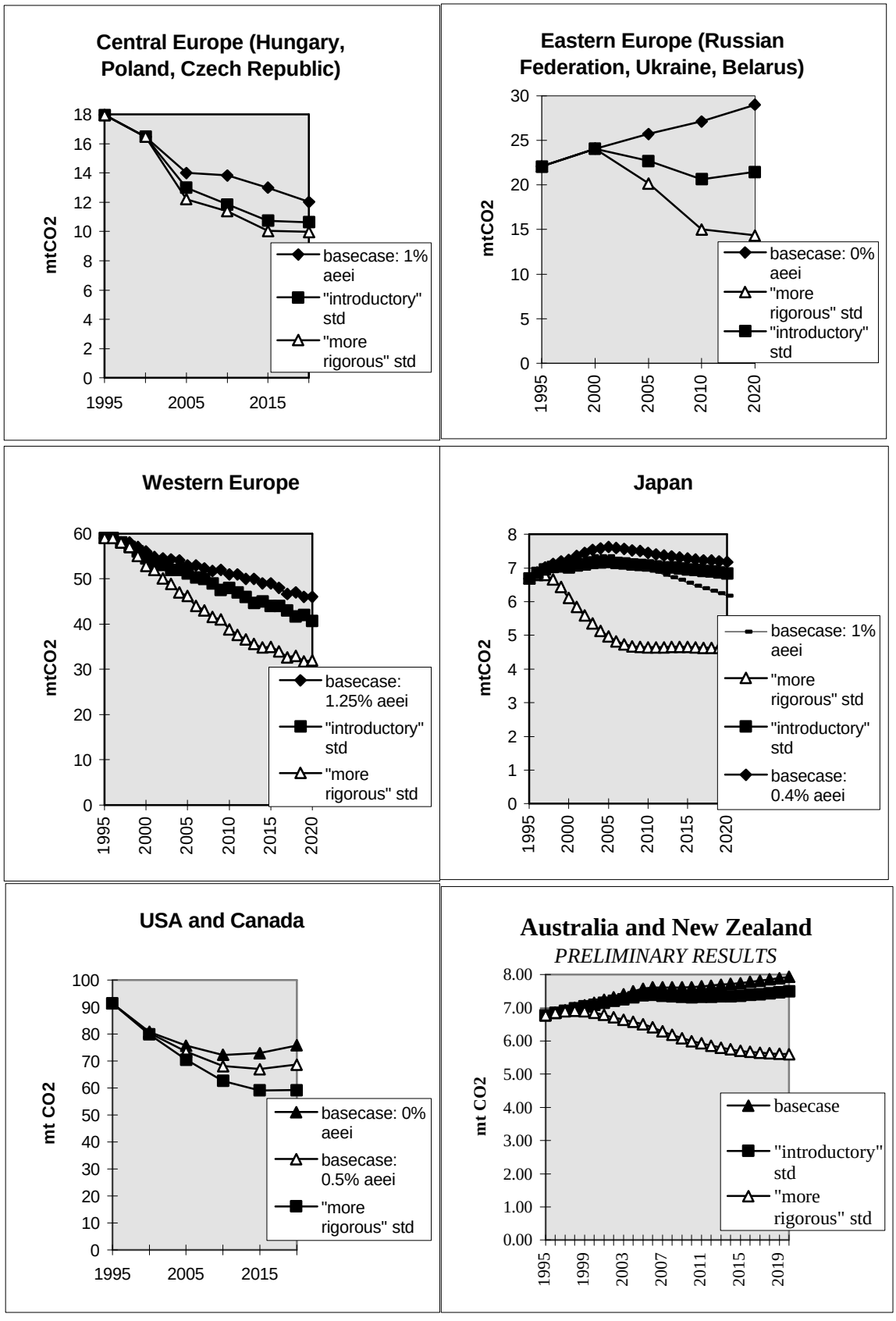
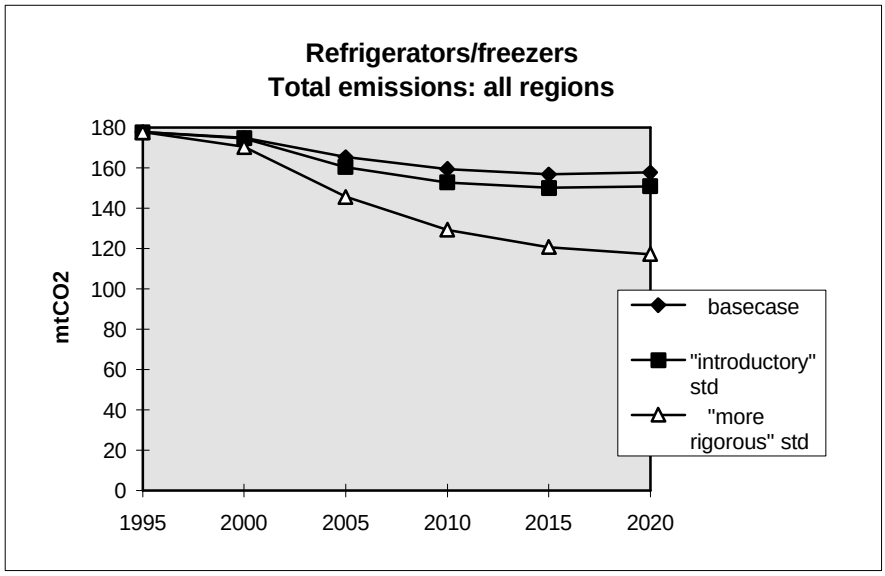
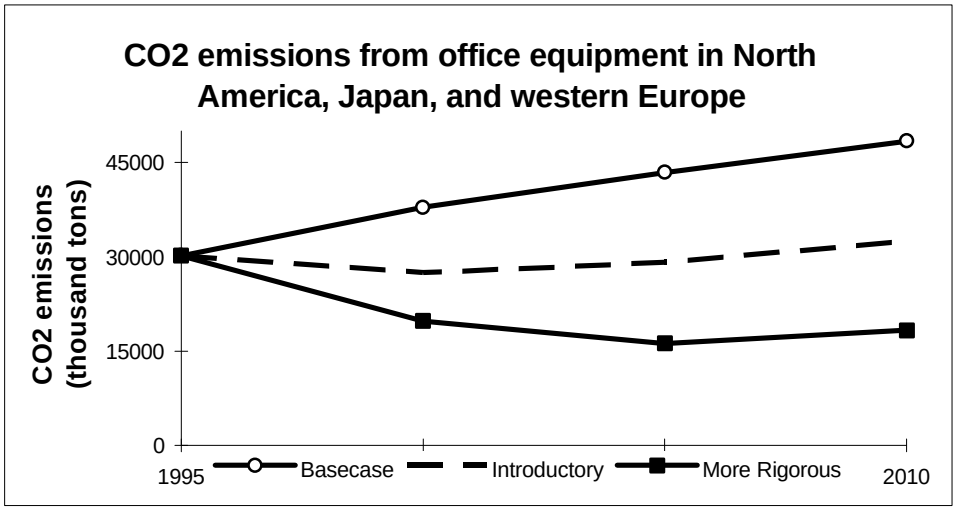


FIGURE 2: COMBINED REFRIGERATOR/FREEZER EMISSIONS SCENARIOS



For office equipment, CO2 emissions in the basecase are expected to increase over the period to 2020 as equipment densities increase. The "introductory standard" scenario for office equipment (equivalent to the US Energy Star level) has a significant effect on CO2 emissions when applied in the 3 Annex I regions included in the analysis (USA and Canada, western Europe, and Japan). Increasing efficiency levels to that of the "more rigorous" level (equivalent to the Swiss target level) gives a correspondingly larger reduction in CO2 emissions. An uncertainty in the analysis is the extent to which office equipment in Japan and Europe already meet the Energy Star requirements, and the extent to which energy saving features are enabled while the equipment is in use.

FIGURE3: TOTAL CO2 EMISSIONS FROM OFFICE EQUIPMENT



Saving energy in office equipment will also affect space conditioning. The issue is a complex one because these effects vary regionally and by building type. This study has not included extra savings that may occur from cooling energy reductions.

Economic effects (costs and benefits)

For refrigerators and freezers, the cost of conserved energy (CCE) for refrigerators/freezers was calculated for the USA, Japan, western Europe and the Czech Republic. The method used was to estimate the increase in product price under a standard and divide this by the physical amount of energy

saved, discounted over the lifetime of the products at two discount rates - 5% and 10%[8]. The CCE is well below the electricity price in the USA, Japan, and western Europe for both the "introductory" and "more rigorous" levels of energy efficiency which suggests investment in more efficient refrigerators/freezers is very likely to be cost-effective for the consumer in these countries. However, in the Czech Republic, a country that is making the transition to a market economy, even the "introductory" level is not expected to be cost-effective for residential consumers at today's electricity prices, although they may be cost-effective when compared with the cost of producing the electricity (no data were available on the cost of electricity supply).

It is difficult to predict the impact that common action to adopt product standards would have on prices faced by consumers. The figures used by the regional analysts to calculate the cost of conserved energy were generally derived from manufacturers' estimates of the increased cost of producing more efficient products. Retrospective analysis of the US 1990 and 1993 refrigerator standards has shown that quality-adjusted prices continued to decline over time consistent with historical trends after the implementation of the standards which suggests they did not have a discernible effect on prices. Increases in first cost are not necessarily fully reflected in increased prices: manufacturers may choose to reduce profit margins so the price increase is lower than the cost increase. However, if the cost is fully passed through to retailers, the retail outlets may put a simple percentage mark-up on the products so that the price increase could be higher than the cost increase.

The data needed to assess the cost of conserved energy for office equipment standards were not available, but experts consulted for this study considered that for office equipment, the "introductory" standards are likely to be cost effective, as significant cost increases are not considered likely. While there were no data on increased cost to manufacturers for the "more rigorous" standards, the more advanced power-management required would have to cost no more than a few dollars per unit to be cost-effective given the short lifetimes of office equipment. The equipment for which the economics are likely to be most favourable are copiers, which also have a longer life.

Political feasibility:

There are wide differences in the national circumstances of Annex I countries, such as different energy prices (which affect the cost-effectiveness of standards), different fuel mix (which affects the impact of standards on CO2 emissions), and different institutional and legal structures (which affect the policy tools that will be most feasible). Efficiency standards are often implemented in the context of other national (or regional) actions such as consumer information, labelling, demand side management programmes, financial incentives to consumers, and incentives to industry which help promote innovation. Implementation options vary from legislation of mandatory regulations drawn up under broad enabling legislation, government procurement policies, voluntary approaches with industry, or energy efficiency labels.

National standards, standards among a small group of countries, or even state or provincial level standards, can have important catalytic effect on the likelihood and political acceptability of standards at a higher level of commonality. Unilateral action to implement standards, although it differentiates the market and can create a barrier to trade, can spur multi-lateral agreements. The Energy Star labelling scheme for computers in the US has influenced the efficiency of computers sold world-wide because the US is such a large market. Alternatively, regional international agreements can also stimulate national action; a multi-lateral commitment can facilitate politically difficult national reforms. Standards which are effectively non binding "technical specifications" can also be drawn up by an international body such as the ISO or the IEC, and then adopted at national level.

[8] The formula used is: $CCE = \delta C/[(1-(1+i)^{-t})/i]\ \delta E$ where δC is the increased first cost of the appliance to the consumer, δE is the physical energy saved (kWh) compared to basecase, $[(1-(1+i)^{-t})/i]$ is the formula for discounting the physical energy saved, i is the discount rate, and t is the lifetime of the product.

Other policy goals:

Energy efficiency contributes to reduced and therefore often cleaner consumption of energy, reducing all (depending on the fuel mix) emissions associated with production of electricity. Efficiency standards also contribute to improvement of trade flows, economic growth, and reduced dependence on imported electricity. Energy efficiency product standards could have small effects on employment, trade, and foreign investment.

Barriers to successful implementation and options for addressing them:

Product standards are static instruments that can be viewed as frustrating dynamic and creative solutions. This potential barrier to implementation can be reduced if performance based standards are used, rather than requirements for specific technology.

Monitoring and enforcement costs can be significant given the large number of products that are regulated, the rate of technological innovation, and the complex technical nature of the standards. For central and eastern Europe lack of institutional and legal capacity is a barrier to implementation, monitoring, and enforcement of standards. Difficulty integrating product standards into existing environmental and energy legislation may be a barrier in some countries.

The time allowed between the adoption of standards and their implementation greatly affects the acceptability of standards to industry. If too short an interval is allowed then opposition will be strong from manufacturers who are unable to sell their lower standard stocks and adapt their product lines before the standard is implemented.

Time period:

Product standards on fairly long-lived products would have some effect on emissions in the short term but much greater effect in the longer term. Office equipment standards would have greater effect sooner than standards on longer life products such as refrigerators. Refrigerator/freezer standards in Japan (where the fridge lifetimes average 8.5 years) would have greater effect much sooner than in the US (where fridge lifetimes average 19 years).

European Union experience suggests that the time needed for researching, planning, and negotiating common standards at Annex I level could be about five years. It is possible that common action on product standards could occur in a sequence of steps that could be taken gradually by all Annex I countries. It is also possible that different options could be agreed to by different countries at different times. Some countries with economies in transition, for example, may not be in a position to commit to adopt common standards within the same time-frame as other Annex I countries. Gradually increasing standards according to a schedule announced well in advance would minimise costs to manufacturers.

Impact on other countries:

Energy efficiency performance standards could have impacts on energy efficiency, greenhouse gas emissions, foreign investment, and trade in non-Annex I countries and non-participating Annex I countries. Common action could lower costs for manufacturers who sell into Annex I markets by reducing the measurement and certification costs that they incur for each different test protocol or standard, but manufacturers who were not able to increase the efficiency of their products to meet higher standards would lose the ability to compete in the markets of countries who are party to the agreement.

The negative implications of Annex I refrigerator standards for non Annex I countries are likely to be small in the near term because refrigerators/freezer characteristics differ from region to region and there is consequently very little trade in refrigerator models between regions. The implications for non Annex I countries of common office equipment standards are also likely to be small since the majority of producers at present are in Annex I countries. The United States “Energy Star label programme has already become

the starting point for a "de facto" international energy efficiency standard for office equipment world-wide.

The adoption of minimum efficiency standards at multi-national level should stimulate the diffusion of more efficient technology to other countries, which would raise energy efficiency in these countries, lower their energy consumption costs, and reduce emissions associated with energy production.

Conclusion:

Given the variety of national institutional and administrative structures, existing policies, and different preferences or requirements for legislation, approaches to implementation are likely to vary greatly among Annex I countries. It is also possible that different options could be agreed to by different countries at different times. Some levels of energy efficiency make it unlikely that the same policy instruments could be used by all countries. For example, some countries with economies in transition may not be in a position to commit to adopt common standards within the same time-frame as other Annex I countries. To achieve benefits from common action in terms of reduced greenhouse gas emissions, it is important to achieve better energy efficiency levels. To achieve trade benefits from common action, countries would need to adopt the same minimum energy efficiency levels. Possible options for common action are:

Option 1: Cost effective energy efficiency level

An option for common action is for Parties to agree to target cost-effective energy efficiency levels in specific products. Different levels of energy efficiency will be cost-effective for different countries. Although trade benefits would derive from common standards, from the point of view of cost-effectiveness, there is no reason that standards should be the same across countries. Analysis by national experts would be needed to assess the most cost-effective levels of energy efficiency, and agreement to implement these levels.

Option 2: Harmonisation of test protocols and measurement techniques

Harmonisation of measurement procedures and testing protocols would provide a foundation for standardisation of product requirements in the future. Manufacturers with a presence in more than one major market, and those wishing to expand to other markets, would benefit from harmonised test protocols or standards as the current multiplicity of tests and standards required by national programmes is very costly for manufacturers wishing to sell in more than one market.

Option 3: Minimum energy performance levels

Common minimum levels of energy efficiency would improve energy efficiency in some countries significantly, while in principle making no difference to energy efficiency in countries that have already exceeded the minimum level. However, some CO2 emissions reductions would result and there would be additional trade benefits if countries adopted the same energy efficiency standards. Products that are traded widely are likely to be good candidates for agreement on common energy efficiency levels that could be achieved through a variety of policy instruments. Such agreements will facilitate trade in the products among countries that are party to the agreement.

- **Refrigerators and freezers** are traded predominantly within regions, because consumers in different regions like very different product characteristics in their refrigerator/freezer appliances. For this reason, it seems likely that while trade benefits would occur from regional common action, Annex I wide common action would add little additional benefit and make the negotiations on test protocols and energy efficiency levels unnecessarily complex.
- **Office equipment** is traded more widely than refrigerators/freezers and is much more uniform in type across Annex I (and other) countries, so it would be technically more realistic to realise Annex I wide common energy efficiency levels. Rapid improvements in technology for office equipment mean standards would need to be continually updated and strengthened to remain effective.

3.8 AGRICULTURE AND FORESTRY: IDENTIFICATION OF OPTIONS FOR NET GHG REDUCTION†

On a global scale it has been estimated that agriculture presently contributes abut 21-25%, 57% and 65-80% of the total anthropogenic emissions of CO2, CH4 and N2O respectively. Overall it accounts for one-fifth of the annual increase in anthropogenic greenhouse gas emissions mostly due to CH4 and N2O. Forests too are critical components of the climate system: forests contain up to 60-80% of the above ground, and approximately 40-50% of the below ground carbon of the terrestrial ecosystems. Noting these statistics, measures in the forestry and agricultural sectors are considered by Annex I experts to be integral components of a comprehensive program of policies and measures to address climate change. The Tranche I component of the study on "Agriculture and Forestry" provides a preliminary catalogue of possible options for reducing and sequestering greenhouse gas emissions in the forestry and agriculture sectors. The material is intended to underpin a more comprehensive analysis of some particular options in the agriculture and forestry sectors which is expected to be completed during Tranche II of the project. In so doing, the Tranche 1 study identifies a wide range of policy instruments which have effects on GHG emissions in these sectors, including economic instruments such as subsidies/taxes, regulatory measures and restrictions, voluntary and information sharing approaches, and research and development opportunities.

In the agriculture sector, the initial compilation of options considers a range of measures, including:

- the reduction and reform of agricultural support policies;
- cross compliance of agricultural support to environmental objectives;
- the promotion of organic (lower external input) systems of agricultural production;
- reduction of fossil-fuel use in agricultural production;
- enhancement of C sequestration and retention in agricultural soils;
- the reduction of methane emissions, inter alia, by improving manure management systems;
- taxes and levies on mineral nitrogen fertilisers;

In the forestry sector, the study catalogues management measures for:

- preserving biomass in forests with forest management (conservation, development and utilisation policies) including conservation of existing C pools;
- encouraging afforestation for C storage;
- management for substitution by increasing the transfer of forest biomass C into products such as biofuels and long-lived wood products that can be used instead of fossil-fuel based products.

A common feature of many of these measures is that their primary objectives are often not related solely to climate change issues but rather to other goals such as trade liberalisation or reducing environmental pollution and natural resource degradation. "Best practice guidelines" may be one of the policy approaches available. However, due to the fundamental dependence of agriculture and forestry practices on the special and varied circumstances of local situations, the study finds the development of such guidelines is likely to have only limited international applicability

The overall goal of the common action study is to broadly assess the relative potential of a range of cost-effective policies and measures for possible common action by countries and Parties listed in Annex I to the FCCC; this component of the Tranche I effort begins with a catalogue of a wide range of response options in the agriculture and forestry sectors. The work considers both existing measures (currently being employed by Annex I Parties) as well as some proposed actions that are not widely employed. The Tranche I study did not attempt a detailed evaluation of the relative merits of the individual measures. The draft report circulated as part of Tranche I is expected to form the basis of future work for examining some particular options in each of these sectors.

3.9 FINANCING ENERGY EFFICIENCY IN COUNTRIES WITH ECONOMIES IN TRANSITION†

The Tranche I component of the study on "Financing energy efficiency in countries with economies in transition" provides a preliminary assessment of energy efficiency potential in 6 EIT countries, describes barriers to energy efficiency, and outlines the roles of international finance institutions and the private sector in financing energy efficiency in EITs. The study identifies a large potential for reducing greenhouse gas emissions by improving energy efficiency in EIT countries.

The focus of this initial paper is on options to improve energy efficiency and reduce greenhouse gas emissions through improved financing of energy efficiency investments in both energy supply and energy demand. Noting that investment flows to EITs are at present an order of magnitude lower than the level estimated to be required to fund energy efficiency projects in EITs with even a short-term payback, the project seeks to identify a number of the most significant barriers to investment. Barriers identified include macro-economic instability, unstable and in some cases subsidised energy prices, investor uncertainty, weak banking sectors and scarcity of domestic capital, energy policies which do not provide incentives for energy efficiency, policies of Multilateral Development Banks (MDBs) and other financing institutions which do not favour small scale projects, and lack of experience in developing and appraising projects.

Two areas given significant focus are the MDBs and private sector lending. MDBs are key actors in financing energy efficiency in EIT countries because of the large scale of their lending. MDBs often have policies that favour energy efficiency, but, where they do not have policies or where the policies are not reflected in their operational activities, MDBs may inadvertently have a negative impact on energy efficiency project lending. The private sector is also very important, as government funds are limited by budget deficits and by the difficulty raising taxes. In addition, the study notes that more than 90% of environmental funding (including funding for energy efficiency) typically comes from domestic sources such as environmental funds, but a large proportion of the needs for investment are simply not being met.

The study identifies a number of potential solutions to address some of these barriers to increasing energy efficiency in EITs. These include, among others: bilateral development programmes and regional activities such as those between the EITs and the European community; the encouragement of an expanded role for the private sector; Activities Implemented Jointly (AIJ) which could in future provide incentives for investment in energy efficiency; the development of small-scale efficiency projects and the establishment of minimum lending level criteria; national energy and pricing policies; activities undertaken through existing multilateral agreements (e.g., the Energy Charter, the ECE, and the agreement on Long Range Transboundary Air Pollution); and efforts underway through the Project Preparation Committee's project and investor matching programme. A more detailed assessment of some of these options is envisaged to be the focus for the next phase of this project.

The draft report circulated as part of Tranche I is expected to form the basis for future work to assess specific options for common action. This study was designed to provide information from which to develop options for full analysis. While this paper may therefore be regarded only as a detailed scoping study, it is hoped that the ideas in it will provide useful input to the AGBM. The Annex I Experts Group envisages that the full report, following the next round of work (Tranche II), will conform to the format of other papers.

4. Insights Gained on Common Actions Through the Conduct of Tranche I Studies

The Annex I Expert Group found the conduct of the Tranche I studies on Policies and Measures for Possible Common Action to be a valuable exercise. It is hoped that this will provide a useful body of timely and relevant information to both Annex I and non-Annex I Parties in the AGBM, as well as others interested in the FCCC process. The preliminary results obtained to date should be directly relevant to the discussion of policies and measures under the Berlin Mandate.

The policy response options in those sectors chosen for analysis proved to be especially illuminating because of the structural and other differences encountered among countries, regions and sectors. The experience gained by pursuing these analyses in parallel suggests both the potential breadth of greenhouse gas response options available as well as their complexities. These findings may apply to other policies and measures not studied in Tranche I. The studies were particularly useful as a means to apply and evaluate the framework for analysis which was developed under the project. For a variety of reasons, comparison of the preliminary results of the individual studies, including the performance of the policies and measures they consider, is complicated.

Experience gained from the Tranche I studies shows that the analysis of any policies and measures for possible common action would benefit from: (i) an information gathering phase regarding the policy instrument(s) in question, aiming to identify relevant past experience and the range of actions in each sector and across sectors which might be assessed for pursuit in common; and (ii) a specific study of a limited range of these options as examples for possible common action, following the framework for analysis to consider, *inter alia*, the performance, cost and feasibility issues outlined in the framework for each option.

Key findings, such as the emissions reduction potential, the economic effects and the impact on other countries of possible common actions, are heavily dependent upon a rich understanding of the measures, especially how they might operate under expected real world conditions. Because of time constraints and a lack of information in some areas, however, none of the Tranche I studies could provide a full assessment of each of the issues identified in the analytical framework. Therefore the Tranche I studies should be viewed as preliminary assessments of policies and measures for possible common action.

Not all policies and measures included on the list for analysis by the Annex I Experts Group might be appropriate for all Annex I countries to the same extent, especially when one considers the countries with economies in transition included in Annex I under the Convention and differing national circumstances among all countries. Therefore, specific proposals to pursue any of these measures further in the context of undertaking common action would require targeted analysis to weigh the costs and benefits of such action by the country or countries considering participation.

Despite these limitations and outstanding issues, many possible opportunities for action were identified in Tranche I. As indicated in the framework for analysis and in Section 1.2 of this report, the definition of possible common action ranges across at least four categories: from measures successful in one country that might be replicated in others, to actions fully undertaken as a common policy implemented across all participating countries. Most of the Tranche I studies found options which traversed several or all of these four categories of common action.

The studies also attempted to identify possible vehicles for common action and possible participants in those actions. In a number of instances, several different kinds of potentially valuable co-operation were suggested, including possible co-operation with other policy fora or multi-lateral institutions to support incorporation or enhancement of climate change objectives and policies in their work.

Several of the Tranche I studies suggest that mechanisms to pursue common action could usefully include:

- use of common measurement or reporting procedures (e.g., test protocols for appliances; measurement of energy efficiency levels in buildings; indicators for relative levels of energy or other subsidies; or methods for measuring the greenhouse gas intensity of agricultural or forestry management practices);
- gathering and sharing information on relevant indicators, policies or other nation-specific actions on a regular basis, according to comparable procedures (e.g., information on energy and other subsidies; agricultural and forestry practices and activity; and energy efficiency investments and performance);
- reporting on emissions performance on a disaggregated basis, *inter alia,* by sector (e.g., as is being proposed by the European Conference of Ministers of Transport for that sector).

These and other such possibilities to support common action would benefit from the participation of stakeholders, national experts and policy makers, possibly through existing international fora or mechanisms. A number of such possibilities were identified in Tranche I.

In a separate document, the Annex I Experts Group will be elaborating its plans for a second Tranche of work to be completed ahead of COP-3. Last but not least, the Annex I Experts Group recognises that literally hundreds, if not thousands, of policy response options exist which simply could not be studied to this same extent given the time and resources available to this project. It is therefore important that the preliminary results obtained here be considered as indicative of what else might be pursued.

ANNEX A: OUTLINE OF MAIN TASKS AND TIMING OF THE PROJECT

In every step of the project, the OECD/IEA secretariats work closely with Annex I country delegates to define the issues to be assessed and approach to be taken. There are several main tasks of the project, each characterised by a series of sub-tasks or products:

1. Defining the scope of the project

- define term "common action;" (late 1994)
- define "policies and measures;" (early 1995)
- identify the full range of policies and measures implemented by Annex I countries and possible "candidates" for common action; (March 1995)
- agree on specific policies and measures for detailed analysis (list referring to Tranche I and II) (November 1995)
- agree on the scope and approach for the individual studies in Tranche I (Jan. 1996) and future follow on work, Tranche II (July 1996)

2. Developing framework for analysis

- initial framework for analysis proposed (June 1995)
- test framework with three preliminary case studies (September 1995)
- revise framework and use for Tranche I analysis of select list of policies and measures.
- (January 1996)
- revise framework if necessary based on results from Tranche I for use in future work (July 1996)

3. Analysing (comparative) performance of possible common actions

- conduct Tranche I studies (January - June 1996)
- report to AGBM-4/COP2 (July 1996)
- conduct follow on Tranche II studies (proposed July 1996 - 1997)
- report to AGBM-5, AGBM-6 and COP3 (December 1996 and 1997)

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