Tables & Figures

Table 13.1. *Policy Choice Criteria and Potential Benefits of Tradable Permits*

	Nature of Criteria	Potential Benefits from Tradable Permits
Economic Efficiency		
Pareto optimality	The level of stringency of the target is optimal and the instrument chosen reaches this target at lowest-cost relative to all other alternatives.	The optimal level of the cap chosen in a tradable permit regime results in the equalization of marginal benefits with marginal costs.
Cost effectiveness	The magnitude of savings to reach a given environmental target relative for the instrument chosen relative to some alternative.	Equalization of marginal abatement costs for a given level of emissions. Analogously, for tradable natural resource quotas, permits will be supplied by those who receive lesser value from their use to those who receive relatively greater value.
Market efficiency	The efficiency of the market – i.e. absence of market power or significant transaction costs in the case of tradable permits.	Potential gains from trade within the permit market are fully exploited.
Environmental Effectiveness		
Certainty of aggregate cap	The certainty with which a given environmental target is reached.	A binding constraint on the use of the natural resource or the level of emissions through the cap.
Monitoring accuracy	The extent to which the regulator is able to ascertain whether a given environmental target has been met.	The installation of continuous monitoring systems is required in order to ensure that permit use reflects actual emissions or resource exploitation.
Compliance and enforcement	The likelihood that the regulator will ensure that transgressions are penalized.	Penalties for excessive resource use or pollution emissions are enforced, ensuring that the cap is not breached.
Local or temporal impacts	The extent to which the policy addresses the heterogeneity of impacts by space and time.	If resource use or pollution emissions have different environmental consequences these are reflected within the permit system, such as through trade restrictions.
Soft Effects		
Data accuracy	The extent to which the policy affects the likelihood of having reliable data.	When setting up a baseline-and-credit system, reliable data is gathered on existing emission levels or resource use.
Bureaucratic culture	The extent to which the policy results in more pro-active management of environmental concerns in private and public bureaucracies.	Eencouraging firms to see environmental management as analogous to management of financial asset.
Dynamic Effects		
Rate of innovation	The extent to which the policy encourages a rate of innovation which is optimal.	Providing continuous incentives for innovation in environmentally- preferable technologies.
Direction of innovation	The extent to which the policy encourages a direction of innovation which is optimal.	By allowing firms full flexibility in determining the most efficient technological means of mitigation.
Administrative costs		
Start-up costs	The cost of putting in place the programme in the first instance.	Since many baseline-and-credit schemes arise out of existing regulatory systems, can be introduced at little cost.
Running costs	The cost of overseeing and maintaining the programme during the course of its lifetime.	By using a decentralized market as the means of implementation, can be parsimonious with respect to costs for central authorities.
Social Impacts		
Distributional impacts	The extent to which the policy results in adverse (regressive) impacts.	Separation of distributional effects from efficiency effects through the permit allocation mechanism.
Participation	The extent to which the policy allows for broad stakeholder involvement.	By allowing any agent to purchase permits, can encourage broad participation in meeting the environmental objective.

Table 13.2. *Hypothesis and Findings Relating to Economic and Regulatory Instruments – (Source: Harrington, et. al.)*

Hypotheses favourable to EI instruments	Supported?	Comments
1. Static efficiency. Incentive instruments are more efficient than regulatory instruments.	Yes	If the emission standard is stringent enough, as in the German SO_2 ordinance, then there is no advantage to incentives.
2. Information requirements. Generally, incentive instruments require less information than regulatory instruments to achieve emission reductions cost-effectively.	No	All policies turned out to require much information, although not necessarily for the purpose of achieving cost-effectiveness.
3. Dynamic efficiency. The real advantages of incentive instruments over regulation are only realized over time, because unlike regulatory policies they provide a continual incentive to reduce emissions, thus promoting new technology, and they permit a maximum of flexibility in the means of achieving emission reductions.	Yes	This often shows up not in patentable innovations but in site-specific changes to equipment and operating practices.
6. Administrative burden. Regulatory policies have higher administrative costs. During the pre-implementation phase, greater information is required to prepare emission standards.	No	
11. Adaptability. Compared to incentive instruments, regulatory instruments can be changed more quickly and easily in response to changing environmental or economic conditions.	No	Many primarily regulatory policies show adaptability by adopting incentive instruments.
12. Cost revelation. With incentive instruments, it is easier to observe the cost of environmental regulation.	Yes	
Hypotheses favourable to regulatory instruments		
4. Effectiveness. Regulatory policies achieve their objectives quicker and with greater certainty than incentive policies.	No	Does not apply at the aggregate level.
5. Regulatory burden. Regulated sources will tend to prefer regulatory instruments to incentive instruments, because of the strong possibility that they have to pay more under incentive even though the social costs may be less.	Yes	The only major incentive policies that have been adopted have overcome this problem by designing instruments to be revenue-neutral (i.e., grandfathered tradable permit systems or recycling of effluent tax revenues)
7. Hotspots and spikes. The performance of all pollution-abatement instruments is seriously compromised for pollutants with highly differentiated spatial or temporal effects, but more so for incentive than for regulatory instruments.	Yes	Incentives can be made local, however, as is illustrated by congestion fees in some cities.
8. .Monitoring requirements. The monitoring requirements of incentive policies are more demanding than those of regulatory policies because they require credible and quantitative emission estimates.	No	Monitoring requirements of both instruments have been exacting.
10. Effects on altruism. Economic incentives encourage the notion that the environment is "just another commodity" and reduce the willingness of firms and citizens to provide environmental public goods voluntarily.	No	

Table 13.3. *Elements of Agreements*

Agreement	Goal	Action	Participation	Compliance Provisions	Other Elements
UNFCCC	'Stabilization of concentrations'	Annex I Parties to 'return emissions to 1990 levels by 2000'; all Parties to inventory emissions and take policies and measures	Open to all Parties, commitments differentiated between Annex I, non-Annex I and Annex 2 Parties	No provisions for non-compliance	Contains principles and preambular language
Kyoto Protocol	Achieve quantified emission reduction limits	Set quantitative caps (emission limits and a timetable for achieving them) for Annex B Parties	Annex B Parties	Contains compliance provisions including the establishment of a compliance committee	Contains preambular language, but no new principles
Convention on International Trade in Endangered Species of Wild Fauna and Flora	No explicit 'Goal' although preambular language includes focus on protection of species of fauna and flora	Regulation of trade in species listed in appendix	Open to any State	Contains compliance provisions, including at State level and provisions for dispute resolution	Includes preambular language and 'Fundamental Principles'
Convention on Biological Diversity	Conservation of biological diversity and the sustainable use of its components	Develop strategies to identify, monitor and seek to protect biological species and ecosystems, as well as use components of biological resources sustainably	Open to any State	No compliance/non-compliance provions	Includes preambular language and Principle (State's sovereign right to exploit resources)
Montreal Protocol on Substances that Deplete the Ozone Layer	No explicit 'Goal' although preambular language includes text calling for the 'protection of the Ozone Layer'	Each party is to reduce production of an agreed list of ozone depleting substances	Open to all States taking on obligations	Has both compliance provisions for Parties and non-Parties	Contains preambular language, but no new principles
Stockholm Convention on Persistent Organic Pollutants	Protect human health and the environment from persistent organic pollutants	Each Party is to prohibit and/or take legal and administrative measures to eliminate production and use (including import and export) of listed persistent organic pollutants	Open to all Parties taking obligations	Convention calls for development of non-compliance procedures	Contains preambular language, but no new principles
Directive of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading	No explicit Goal, although a statement in text calls for 'Promot[ing] reductions of greenhouse gas emissions in a cost-effective and economically efficient manner.'	Establish a system for trading greenhouse gas allowances	Open to all members of the European Union	Contains detailed compliance provisions; implementation primarily a role for States	Preambular language, but no separate section on principles
European Commission recommendation on the reduction of CO_2 emissions from passenger cars (note: separate agreements with European, Japanese and Korean automobile manufacturers)	Achieve CO_2 emissions targets for average new cars sold in the EU	European, Japanese and Korean vehicle manufacturers , through technological development and market changes, improve average vehicle emissions sold in European market	European Commission, and automobile manufacturers of Europe, Japan, and South Korea	No separate provisions, but preambular language indicates that legislative proposals would be forthcoming if achievement of goal is not met voluntarily	Preambular language, but no principles

Table 13.4. *Overview of multilateral carbon funds*

	Type	Name	Investors	Launch	Investment Goal
Multilateral Funds	Public-Private Partnerships	World Bank BioCarbon Fund	Public and private entities	May 2004	USD 100 million
		World Bank Community Development Fund	Public and private entities	July 2003	USD 128 million
		World Bank Pan-European Carbon Fund	European Investment Bank	June 2005	USD 100 million
		World Bank Prototype Carbon Fund	Public and private entities	July 1999	USD 180 million
		Andean Development Corporation's Latin American Carbon Program	Private and public entities, including the Dutch government	1999	USD 45 million
		Asian Development Bank's CDM Facility	Public and private entities	August 2003	USD 70 million current budget
		Baltic Sea Region Energy Cooperation (BASREC) Testing Ground Facility (TGF)*	Governments of Denmark, Finland, Iceland, Norway, Sweden. Germany intends to contribute	December 2003	EUR 30 million
		European Bank for Reconstruction and Development's Multilateral Carbon Credit Fund	Public entities, including 9 EU governments	July 2005	EUR 50-150 million
		KfW	Private and public entities, including the German Carbon Fund	June 2004	EUR 50 million
		Singapore-ASEAN Carbon Facility	Public and private entities	2003	USD 120 million
	Private Funds	Asia Carbon Fund	Public and private entities	March 2005	EUR 200 million
		EcoSecurities – Standard Bank Carbon Facility	Private and public entities, including the Denmark Carbon Facility	May 2003	DKK 59 million
		European Carbon Fund	CDC – Ixis, Fortis Bank	January 2005	EUR 105 million
		Japan GHG Reduction Fund JBIC-JGRF-JCF	Japan Carbon Fund	December 2004	USD 141.5 million
		Natsource's Greenhouse Gas Credit Aggregation Pool	Public and private entities	February 2005	USD 130 million
Approximate funding total: USD 1.67 billion					

* The TGF is also open to private investors.

Table 13.5. *Overview of Government Carbon Funds*

	Type	Name	Investors	Launch	Investment Goal
Single Government Funds	Own Tender	Austria JI/CDM Program	Austria	2003	EUR 72 million
		Belgium JI/CDM Tender	Federal Government of Belgium	May 2005	EUR 10 million
		Climate Fund	Canada	April 2005	CAD 1 Billion
		Denmark JI/CDM Program	Denmark	2004	EUR 100 million
		Finland JI/CDM Pilot Program	Finland	May 2003	EUR 20 million
		French Carbon Fund	France	February 2005	EUR 50 million
		CERUPT	The Netherlands	2001	EUR 32 million
		ERUPT	The Netherlands	2000	EUR 50 million
		Sweden International Climate Investment Program	Sweden	2000	SEK 350 million
		Government of Japan	Japan	March 2005	JPY 5.7-8 billion
		Swiss Climate Penny	Switzerland	June 2005	EUR 65 million
	Through Multilateral Institutions	World Bank Netherlands Clean Development Facility	Government of the Netherlands	May 2002	EUR 136 million
		World Bank Danish Carbon Fund	Danish investors only: public and private	November 2004	USD 30 million
		World Bank Italian Carbon Fund	Italian investors only: public and private	January 2004	USD 80 million
		World Bank Spanish Carbon Fund	Spanish investors only: public and private	November 2004	EUR 170 million
		IFC	Netherlands Carbon Facility	January 2002	USD 44 million
		IFC-IBRD	Netherlands European Carbon Facility	2002	USD 70 million
		Rabobank Carbon Procurement Department	Netherlands	Summer 2003	EUR 45 million
Approximate funding total: USD 2.06 billion					

Table 13.6*. (listed below as table A2)*

Table A2: Indicative assessment matrix for the qualitative comparison of the approaches. Source: Höhne et al. 2003

Criterion \ Approach	Possible weighting	Continuing Kyoto	Intensity targets	Contraction and convergence	Global Triptych (CO_2 only)	Multi-sector convergence approach	Multistage approach (FAIR)	Equal mitigation cost	Coordinated Policies and measures	Extended global Triptych	New multi-stage	Performance targets
Environmental criteria	**3**	**+**	**0**	**++**	**+**	**++**	**+**	**0**	**+**	**+**	**++**	**+**
Environmental effectiveness		++	+	++	++	++	++	++	0	++	++	+
Encouragement of early action by Parties that do not yet have binding commitments		-	-	++	0	+	/	--	++	0	+	+
Political criteria	**3**	**0**	**0**	**0**	**+**	**0**	**++**	**0**	**0**	**+**	**++**	**0**
Equity principles		+	0	+	+	+	++	0	-	+	++	+
Agreement with fundamental positions of major constituencies		0	+	-	+	0	+	-	0	+	+	0
Economic criteria	**2**	**0**	**0**	**-**	**+**	**+**	**+**	**++**	**-**	**++**	**+**	**++**
Accounting for structural differences between countries		/	/	--	+	+	+	++	-	++	+	++
Minimizing adverse economic effects		+	+	+	+	+	+	++	-	+	+	+
Technical criteria	**1**	**++**	**0**	**++**	**0**	**0**	**+**	**-**	**0**	**0**	**+**	**0**
Compatibility with UNFCCC and Kyoto Protocol		++	+	+	+	+	+	+	0	+	+	+
Moderate political and technical requirements of the negotiation process		++	-	++	-	-	+	--	-	-	+	-

Note: '--' criterion completely not met, '-' criterion mainly not met, '0' neutral, '/' depends on the specific variation of the approach, '+' criterion mainly met, '++' criterion completely met

Table 13.7. *(listed below as table A1)*

Table A1: Alternative international policy architectures for global climate change. Source: Aldy, Barrett and Stavins 2003

Alternative	Environmental Outcome	Dynamic Efficiency	Cost-effectiveness	Distributional Equity	Flexibility	Incentives for Participation and Compliance
Kyoto Protocol	Probably low, given short-term nature of commitments, and poor incentives for participation and compliance.	Requires reductions that are too large in short run, and silent on reductions required for long run.	Flexible mechanisms help cost-effectiveness, but non-participation by key countries reduces cost-effectiveness; CDM burdened by transactions costs.	Only industrial countries (ICs) face targets, but developing countries (DCs) help shape rules. DCs receive some adaptation assistance.	Emission ceilings are locked in, but only for five-year periods.	Incentives for participation and compliance are very weak.
Aldy, Orszag, & Stiglitz (2001)	Depends on safety valve price and extent of developing country participation.	Allows for policies that could be consistent with dynamic efficiency.	International emissions trading with a safety valve would likely result in common price for all participants.	Delays mandatory emissions commitments by DCs. Safety valve funds to DCs for abatement efforts.	Commitments and safety valve price adjusted over time in response to new information.	Use of sanctions, especially on trade, to promote compliance. Incentives for developing country participation.
Barrett (2001, 2003)	Depends on the agreed standards.	Technology lock-in may impair efficiency, but increased R&D may also lower costs.	Would not equalize marginal costs across all sectors.	R&D funded according to UN scale. ICs pay for technology adoption by DCs; adaptation funded by ICs.	R&D protocol provides information about technologies to lower costs, but standards may create lock-in.	R&D investment, economies of scale, network externalities, and trade restrictions create incentives for participation. No need to enforce compliance.
Benedick (2001)	Depends on levels for R&D, technology standards, etc.	Technology lock-in may be a problem, but public sector R&D may lower costs.	Would not be a global agreement, and would not equalize marginal costs across all sectors.	ICs to transfer new technologies to DCs. US to show leadership in reducing emissions unilaterally.	R&D would provide more information about new technologies.	Participation deliberately restricted, at least initially and in some arens. No explicit mention of compliance.
Bradford (2002)	Would depend on the magnitude of financial contributions to the central authority.	Could potentially support a dynamically efficient outcome.	Common offer bid for emissions allowances to all countries would insure cost-effectiveness.	Financing obligations would reflect ability to pay and expected benefits from mitigating climate change.	Central authority could adjust emissions allowances purchases with new information over time.	Does not explicitly address enforcement of financing obligations.
Cooper (1998, 2001)	Would depend on the level of the carbon tax.	Could potentially support a dynamically efficient outcome.	Common carbon tax would be cost-effective.	Tax would be uniform, but part of revenue could be redistributed to DCs.	Tax level can be changed, to adjust to new information.	Does not incorporate explicit mechanisms. Relies on a "commitment" to treaty objectives

Alternative	Environmental Outcome	Dynamic Efficiency	Cost-effectiveness	Distributional Equity	Flexibility	Incentives for Participation and Compliance
Hahn (1998)	Depends upon levels at which instruments are set	Depends upon levels and time paths of instruments.	Could be cost- effective, due to reliance on market- based and related instruments.	Depends upon allocations.	Very flexible; instruments that perform best are continued.	No attention is given to participation and compliance.
McKibbin & Wilcoxen (1997, 2000, 2002)	Relatively low carbon emissions price implies modest near-term emissions reductions.	Could potentially support a dynamically efficient outcome.	Common carbon price across all countries supports cost-effective implementation.	DCs would receive emissions endowments in excess of current emissions.	Decadal negotiations to select carbon price allows for accounting of new information.	Does not substantially address participation or compliance issues.
Nordhaus (1998, 2002)	Relatively low carbon tax implies modest near-term emissions reductions.	Could potentially support a dynamically efficient outcome.	Harmonized carbon tax insures cost- effective implementation among participating countries.	Participation conditional on per capita income. DCs would also likely receive financial transfers.	Periodic international votes allows for adjusting carbon tax to new information.	Promotes compliance through trade measures. Developing country participation supported through financial transfers
Schelling (1997, 1998)	Would probably have little effect on emissions.	Does not front-load mitigation. Promotes R&D to reduce future mitigation costs.	Would aim to reduce emissions globally.	Financial transfers to DCs.	Emphasizes the need to act, rather than to meet a particular target	Enforcement of compliance not needed by design.
Schmalensee (1996, 1998)	Little effect in short run, but significant effects in long term.	If targets are sufficient, could be dynamically efficient.	Could be cost-effective, due to reliance on market-based and related instruments.	Little attention given to distributional equity in the cross-section, but could provide intertemporal equity.	Quite flexible, due to focus on beginning with modest targets.	No attention given to participation and compliance issues.
Stavins (2001b)	Abatement would be very modest in the short term, but much more ambitious in the long term.	If targets are sufficient, could be dynamically efficient.	Could be cost-effective, due to reliance on tradable permits, carbon taxes, and hybrid systems.	Addresses cross-sectional distributional equity through allocation of permits and use of growth targets.	Long-term targets are flexible, to allow for effects of learning.	Little attention to participation and compliance, except for incentives for DCs.
Stewart & Wiener (2001)	Would depend on the magnitude of the "headroom" allowances given to DCs.	Dynamic efficiency weakened by participation & compliance problems.	Reliance on an expanded CDM, and participation and compliance problems undermine cost-effectiveness.	Headroom allowances to DCs plus emissions trading provide potential economic gains to poor countries.	Emission commitments would need to be periodically negotiated.	Similar to Kyoto Protocol, with exception of incentives from "headroom" allowances.
Victor (2001)	Similar in targets to KP, but with safety-valve sales of additional permits.	Better than KP in its emission path, but not defined.	Includes flexible mechanisms of Kyoto Protocol; hence, can be cost-effective.	By bringing DCs into set of nations facing binding constraints only as they become more wealthy, equity is addressed.	Subsequent periods would need to be renegotiated.	Compliance is considered through buyer liability scheme, but participation is not addressed.

Table 13.8. *Is Trade Good or Bad for the Environment?*

Effects of trade on the environment	**via growth in income**	**for a given level of income**
Harmful effects	larger scale of economic activity	"Race to the bottom" in national regulation
Beneficial effects	shifts to cleaner techniques and composition of economic activity	"Gains from trade": ratcheting up of standards, innovation, consumer power
Statistical evidence on bottom line		
for SO_2	EKC, after an income per capita of about, further growth tends to reduce pollution (via national regulation)	other things equal, the favorable effects of trade seem to dominate
for CO_2	No sign that total emissions turn down on their own (presumably because CO_2 is a global externality: little regulation is possible at national level)	Trade, if anything, may increase emissions even for a given level of income

Table 13.9. *Legal actions in different parts of the world*

Nature of action	Country	Description	Preliminary result[1]
Export credit	Germany	Export credit agencies are not providing information about GHG emissions from their projects	-
	US	Export credit agencies violate national laws	Judgement that plaintiffs had legal standing and in favour of plaintiffs
Misuse of power	Australia	Action claiming that a minister did not have the power to prevent the assessment of greenhouse gas emissions from a project	Judgement in favour of plaintiffs
Notice of obligation towards climate change	Australia	Issued to major GHG emitters	
Negligence	Australia	Action claiming that the Government has failed to take into account the impacts on, i.e. corral reefs.	
Violation of human rights and environmental obligations	Nigeria	Communities are suing the major oil companies for gas flaring resulting in increased local pollution and GHG emissions	
Violation of environmental rights	USA	Some states and NGOs are suing 5 major power companies on nuisance	Court dismissed case – when decisions are political, there should be no judicial review.
CO_2 should be seen as pollutant	USA	States are suing the EPA for failing to regulate CO_2 as a pollutant	
International options			
Violation of human rights	Innuit Community vs USA	Innuit Community planning to sue the USA for violating their human rights before the Inter American Court of Human Rights.	
Enlisting as World Heritage in Danger	Nepal, Peru, Belize	Requesting UNESCO to grant status as World Heritage in Danger (Everest National Park; Belize - barrier reef; Peru - Huarascan National Park)	

Source: Gupta 2005.

[1] This column will be updated to ensure that it provides the latest information on these cases.

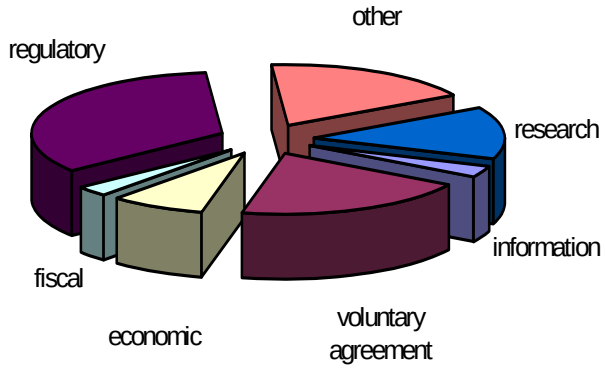


Figure 13.1. *Types of policy instruments to address greenhouse gas emissions in industry and the frequency with which they are used*
Source: UNFCCC (2002c

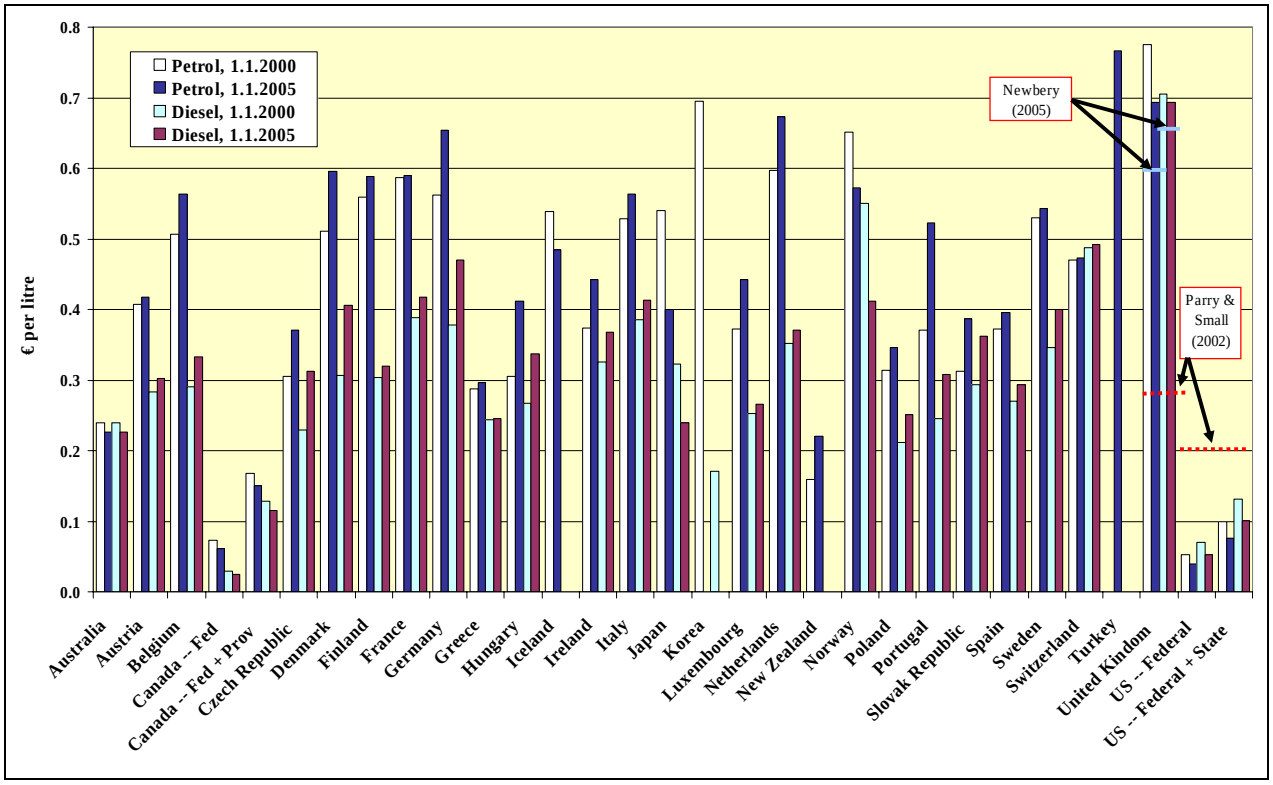


Figure 13.2. Tax rates on petrol and diesel in OECD member countries on January 1, 2000 and January 1, 2005 - Euro per litre

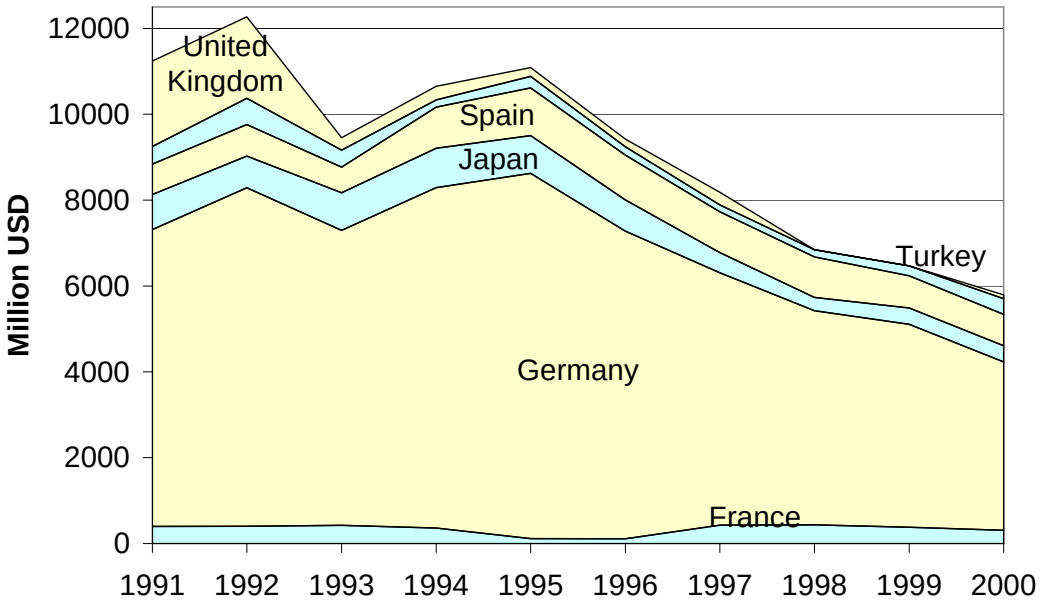
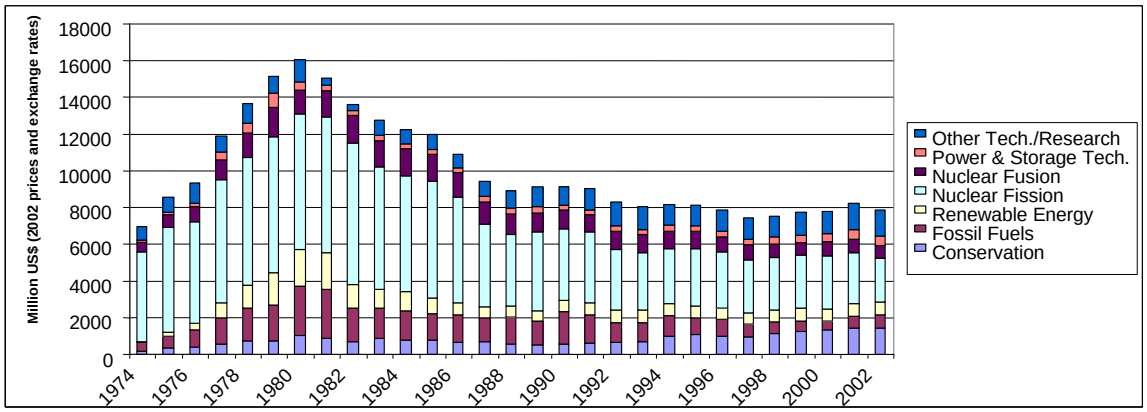
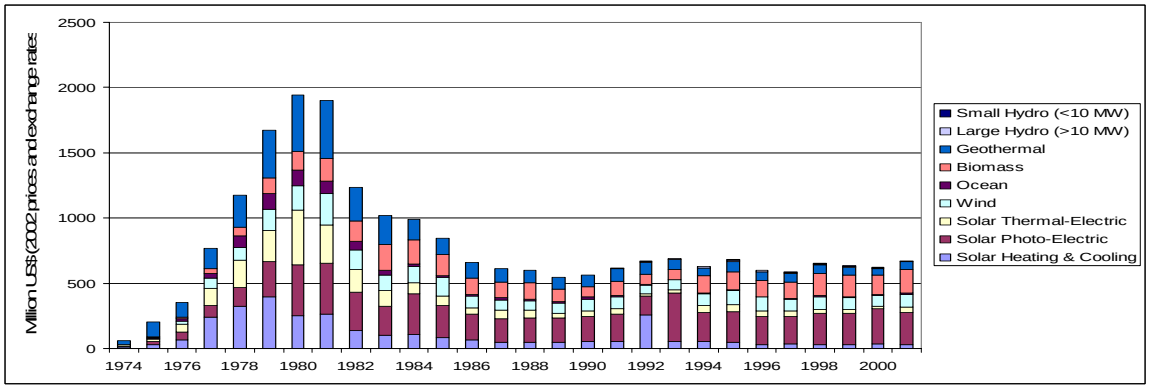


Figure 13.3. *Support for coal in selected OECD (USD million).*

Source: IEA.



(a) IEA Government Energy RD&D Budgets



(b) IEA Government Renewable Energy RD&D Budgets

Figures 13.4 (a) and (b). *IEA member country public R&D expenditures for energy and renewable energy technologies*

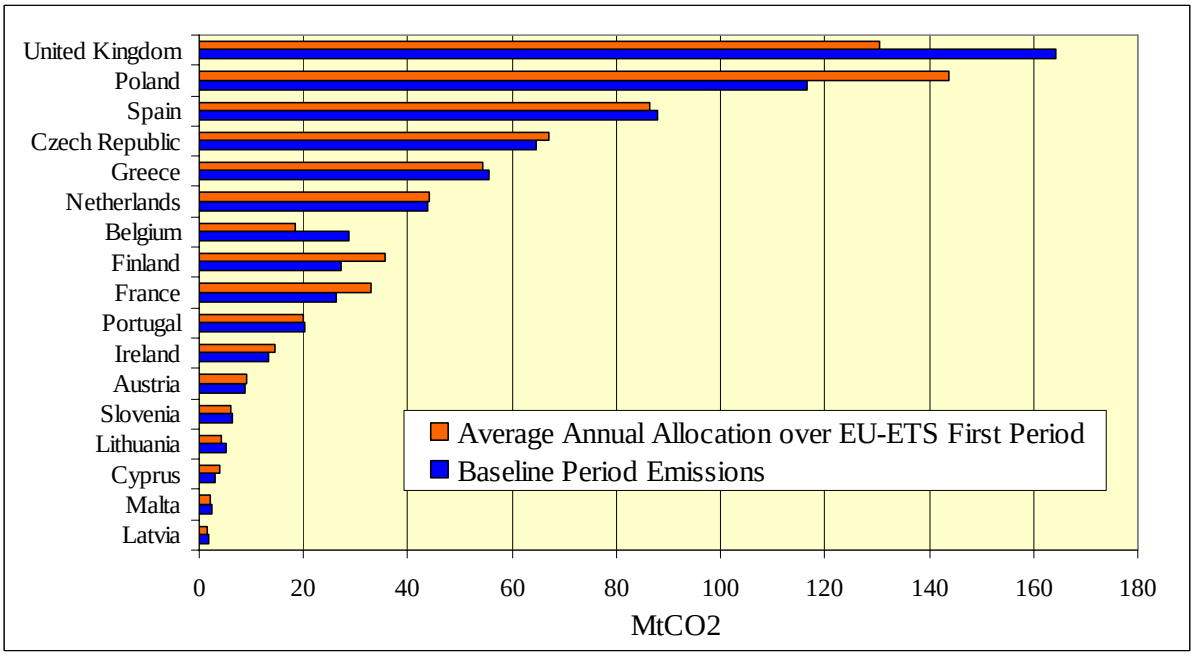


Figure 13.5. *Current country groupings under the UNFCCC, OECD and EU (Höhne et al. 2005)*

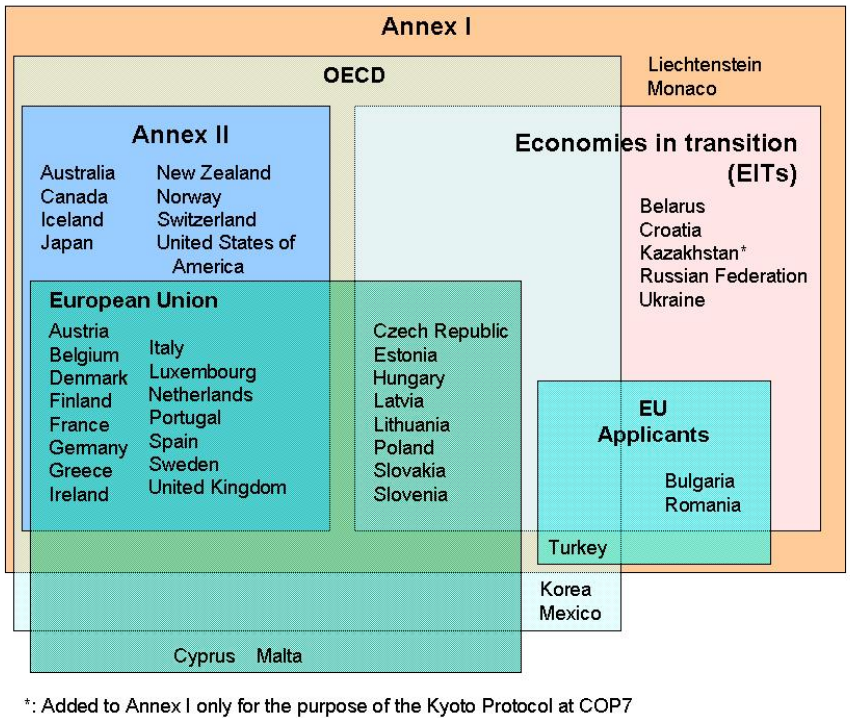


Figure 13.6. *CO_2 allowances in the EU electricity sector (Baron and Philibert, 2005)*

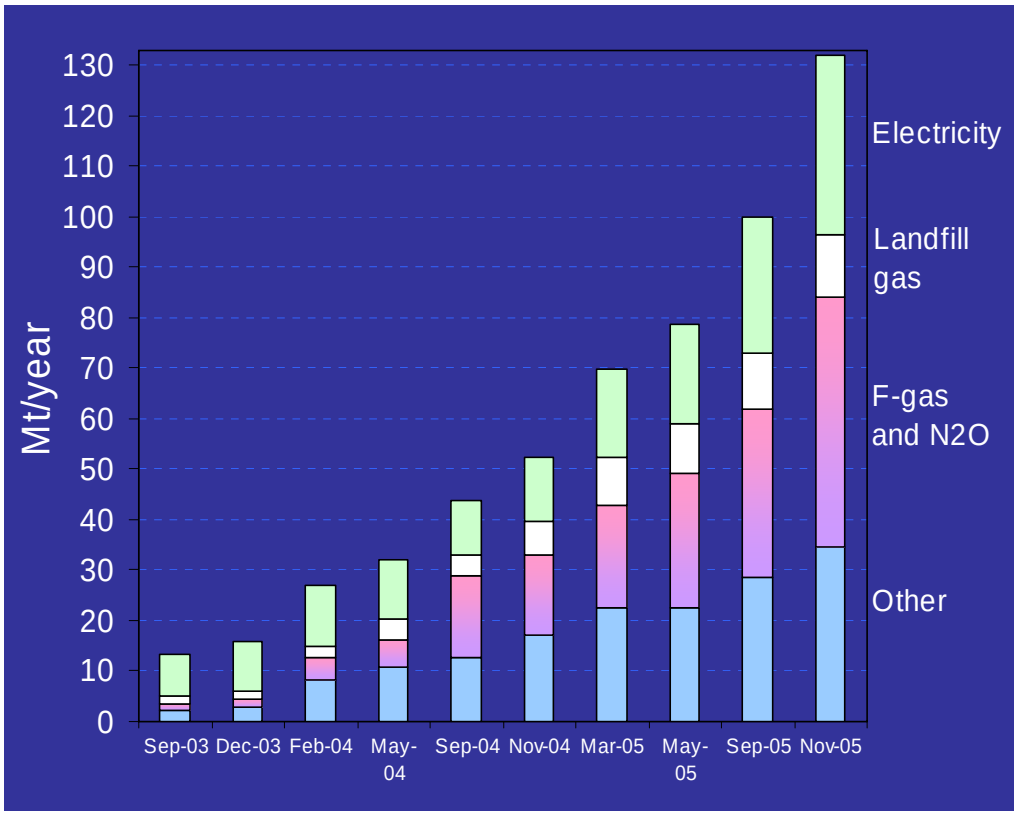


Figure 13.7. *Projected CDM credits in CO_2 equivalents per year during the 2008-12 period (Ellis and Levina, 2005)*

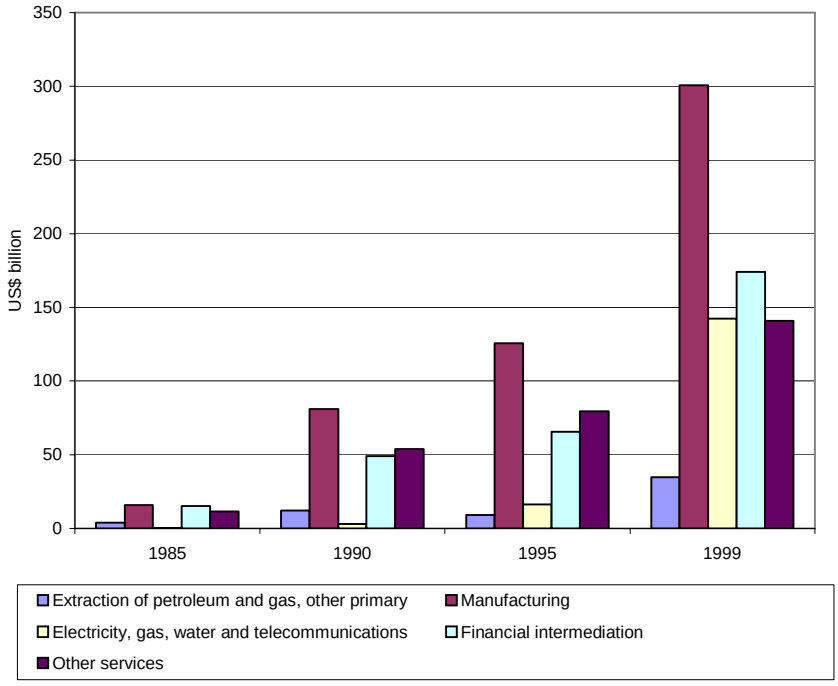


Figure 13.8. *Total OECD FDI outflows to selected sectors (OECD, 2000b)*