EFFICIENCY AND EFFECTIVENESS OF POLICY INSTRUMENTS: CONCEPTS AND PRACTICE

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Abstract: *In this paper a brief overview of types of instruments is given, with particular emphasis on the expected and experienced effectiveness and efficiency of policy instruments. After introducing the instruments, a brief discourse concerning the difficulties in ex ante and ex post assessment is given. Subsequently, a few experiences in Finland and other countries are presented. In the concluding observations some guidelines are given how to move from generic notions to a specific programme.*

Introduction

Instrument selection, even though economic rationality will be important, is always based on a much wider set of notions (Olerup, 2001). Cultural and institutional appropriateness are consciously and unconsciously taken into account (Shove and Wilhite, 1999). Also timing will matter a lot. Another source of confusion in the discussions concerning preferred policy instruments is the variation in understanding of what efficiency and effectiveness actually constitute.

Parties representing somehow responsibility for actual implementation of measures, technologies and – eventually – for observable abatement, tend to stress effectiveness of policy instruments. Since ensuring abatement is important for them it is logic they show a tendency to prefer more straightforward kind of interventions, i.e. trying to connect directly to processes in industry and households. Within the selection of such kind of policies subsequently cost-effectiveness can start to play a larger role in this approach.

Economic policy makers and economists tend to focus on economic efficiency, as this concept automatically implies (or assumes) that the measures taken are effective in terms of achieved abatement. The concern is that inefficient policies cause unnecessary loss of welfare or in the worst case undermine the abatement policy itself, e.g. due to relocation of production capacity or a backlash in willingness to invest and to innovate.

The problem is that both views have a point. Accepting the agreement reached in COP6b on the first commitment period as given, social-economic evaluation methods provide a good starting point[i]. However, it will be essential to insert a lot of information and views regarding ensured effectiveness. Serious monitoring and ex post evaluation of implemented policies will be essential to learn about the conditions for effectiveness.

Classification of policy instruments

Four categories of instrument types can be distinguished, being:

1. *Regulating instruments* that due to direct or indirect intervention influence the volume of the energy or emissions used; a subdivision can be made between:
   a. rationing and prescription (e.g. emission quota, mandatory technologies and procedures)
   b. performance standards and benchmarks (e.g. total material requirement TMR targets, building performance standards)
2. Instruments that imply *deregulation*, either through the establishment of (quasi) markets or by delegating a large degree of freedom to companies or institutions within the framework of a negotiated package deal; examples are:
   a. Emission permit trading and green certificates (for 'green electricity');
   b. Voluntary agreements (maximise degrees of freedom through delegation). A voluntary agreement (VA) can be regarded as a box that can be filled in various ways.
3. *Fiscal and financial instruments*, such as taxes, levies for self financing systems (earmarked tax), subsidies and grants, which either increase the price of polluting to the polluter or decrease the price of being cleaner, and thereby incite (more) action to invest in energy efficiency, abatement, fuel switching or renewables.
4. *Supportive actions*, that aim at the improvement of knowledge levels and market transparency, either by adding knowledge (R&D) or by improving the accessibility (dissemination, training, etc.). Such actions lower the costs, especially the transaction cost, for environmentally benign technical and organisational innovations. Last but not least a systematic evaluation and monitoring of policy implementation belongs to this category. Supportive actions can virtually always be combined with other types of instruments.

Instruments from the different categories can be combined to various extents. Thanks to theoretical studies and model investigations there can be made a preliminary ranking of instruments in terms of their economic efficiency for given set of environmental targets. *Provided a set of basic assumptions is fulfilled*, the following preliminary ranking of the most prominent instruments is generally valid:

1. permit trade and similar type of market creation (item 2a);
2. emission taxation; levies with differentiated schemes and penalties/rewards (item 3);
3. performance standards (item 1b);
4. physical regulation (quota or prescribed technologies, item 1a).

By their nature supportive actions are not listed separately in the above ranking.

Permit trade and taxation, provided the initial auction revenue or the tax revenue is somehow recycled[ii], incur – in principle - the lowest overall social-economic cost. These instruments make the best use of input and output substitution effects, while the net effect of tax interaction and revenue recycling is small. Performance standards don't cause tax interaction neither revenue recycling effects, but – in principle - don't make optimal use of the substitution and abatement mechanisms. In real world circumstances differences in welfare impacts compared to permit trade and taxation can get small (e.g. Parry and Williams, 1999). Quota or prescriptions represent a shadow tax due to

rationing and abolish flexibility in substitution mechanisms. This combined effect makes therefore these kind of direct interventions economically inefficient. A Voluntary Agreement can consist of a combination of the above instruments and consequently the overall result regarding efficiency and effectiveness can be either good or bad.

The proviso about basic assumptions is not a pro forma statement. If actual market conditions deviate substantially from the basic assumptions, both the ranking and the absolute levels of efficiency can be significantly affected. However, physical regulation remains virtually always a less preferable option, from an economic point of view at least. Physical regulation can be justified when non-compliance would incur very high risks of any kind. Also high uncertainty about risks can lead to strict regulation.

In practice *packages* of instruments are implemented. The proper way to construct such packages is by starting to select instruments based on prior knowledge (e.g. from ex-post evaluation) and simple indicators. Subsequently, various package alternatives can be stepwise analysed and amended. The initial selection is important as errors may lead to optimising a non-ideal subset of measures.

The top-down – bottom-up dilemma

In putting up policy packages one can choose a top down approach or a bottom-up approach, the former being more efficiency oriented and the latter more to effectiveness. The top-down approach starts with collecting the most promising instruments. Next, by means of macro-economic modelling, market potential analysis and – hopefully – energy systems studies the efficiency is tested in the framework of a macro economic scenario. In the bottom-up approach effective measures are distinguished by means of engineering-economic studies, that allow for a lot of detail. Given that well defined measures are implemented for a specified extent, emission reductions are certain. However, the needed instruments to bring about the measures, have to be assumed.

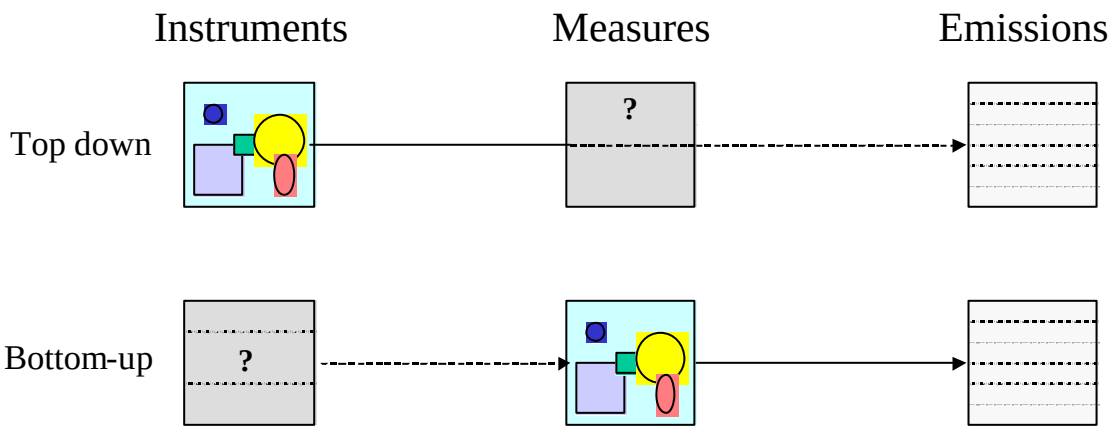

Figure 1. Summarising the course of logic and consequent uncertainties in 2 policy design approaches

The dilemma of both approaches is summarised in figure 1. The top down approach distinguishes and analyses the instrument alternatives well but has to make quite crude distinctions between the possible measures and hence creates an uncertainty. The bottom up approach is detailed about the distinctions and capabilities of measures, but is necessarily simplistic about the instruments that should steer the measures. Though the

different available toolboxes allow us to do detailed analyses on both instruments and measures, there are no methodologies yet that can connect them well and allow for a *simultaneous* analysis. There is however a multitude of attempts to merge the approaches (e.g. Jacobsen, 1998; TCH-GEM-E3 EU 5th framework project).

Connecting instruments to measures
The whole incitement process of instruments targeting at measures is more fuzzy than one may realise using a top-down approach. For a start there is already existing policy (environmental and otherwise) and various new instruments may be introduced, while existing ones are reinforced or abolished. Various possibilities are shown in figure 2.

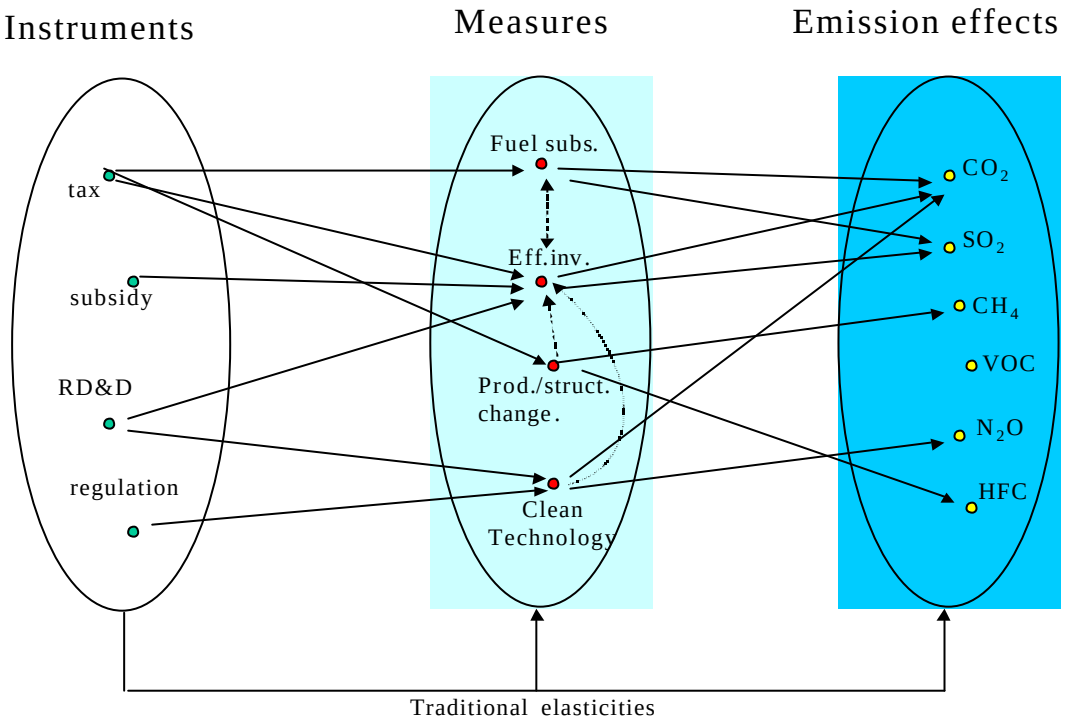

Figure 2. Connecting instruments with measure responsiveness and emission reductions

A carbon tax for example can incite several measures, such as fuel substitution, fuel efficiency improvements, and adaptation in the product mix (skipping 'dirty' products). However, these various measures also influence each other in terms of responsiveness and total potential. Improvement of fuel efficiency reduces the demand for a substitute fuel. By changing the product structure a company may be able to avoid efficiency investments altogether or efficiency improvement gets totally 'hidden' in the new type of capital stock purchased.

Usually not only taxes are applied, but also other instruments. If for example subsidies on renewables are high, it may constitute a disincentive to invest more in energy efficiency. On the other hand if RD&D support enables earlier introduction of more efficient technologies, the incentive from a carbon tax gets enhanced.
A third source of uncertainties is the ultimate impact on emission levels. If the resulting distribution of measures taken is otherwise than expected, the volume of emission reduction is almost certainly different as well.

Imperfections and their consequences

An important underlying assumption in the models available is that all economic agents belonging to the same group have the same level of information. Often this assumption even implies full information[iii]. In reality not all agents in one sector will have equal information and neither will any of them have complete information. This implies that if more tax is added to the fossil fuel price and thereby – in theory – some efficiency or abatement measures become profitable, not necessarily a quick response follows. The agents may be unaware of the new profitable potential or somehow expect higher measurement cost (transaction cost).

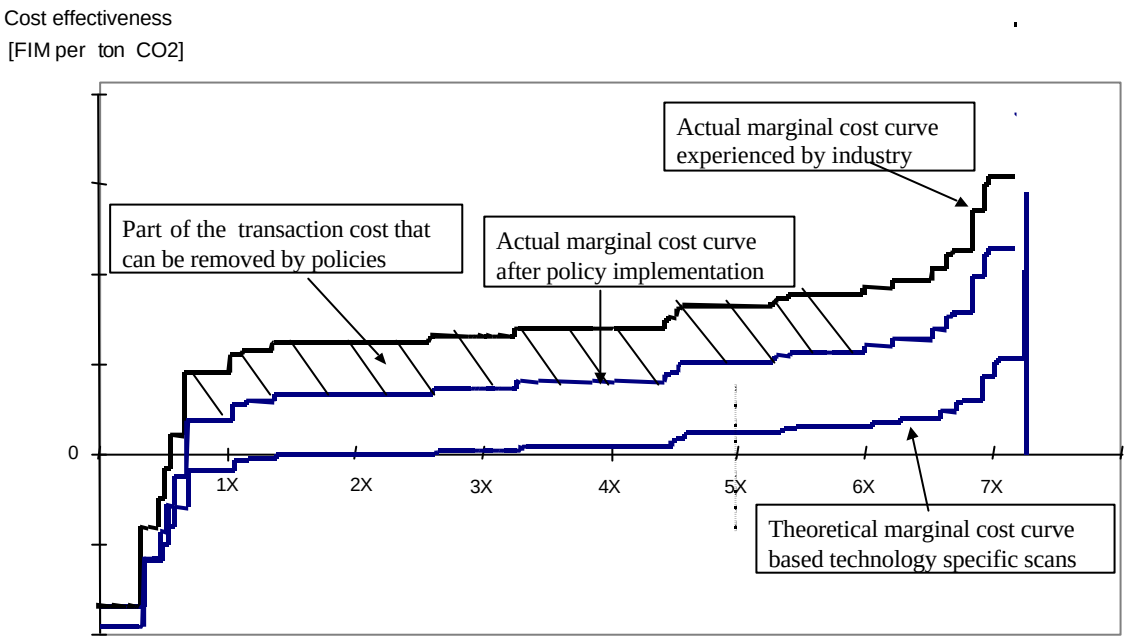

Figure 3. Perceived and 'real' marginal abatement cost

Even if some agents have recognised the option, it may take considerable time until most of the sector has switched, since the spread of the information update in a sector is not instantaneous (asymmetrical information across competitors).

The impacts of transaction cost imply that there is a difference between the 'theoretical' marginal abatement cost curve as obtained through technology scans and the actual marginal cost curve as the industries experience. This is illustrated in figure 3. From a policy point of view it is important to know to what extent the elevated marginal cost curve could be lowered thanks to policies that reduce the transaction cost. Such policies will focus on the increase of knowledge and on the improved accessibility of that knowledge. This will typically mean efforts regarding research and development, demonstration and dissemination (RD&D). Improved accessibility may also involve new concepts for ownership of (commercially relevant) knowledge. Other things being equal, such instruments improve market transparency and thereby make pricing instruments (taxation) more effective. Yet, even with improved knowledge asymmetry may be not easy to alleviate depending on the type of market. For example large variations in company size often contribute to knowledge asymmetry.

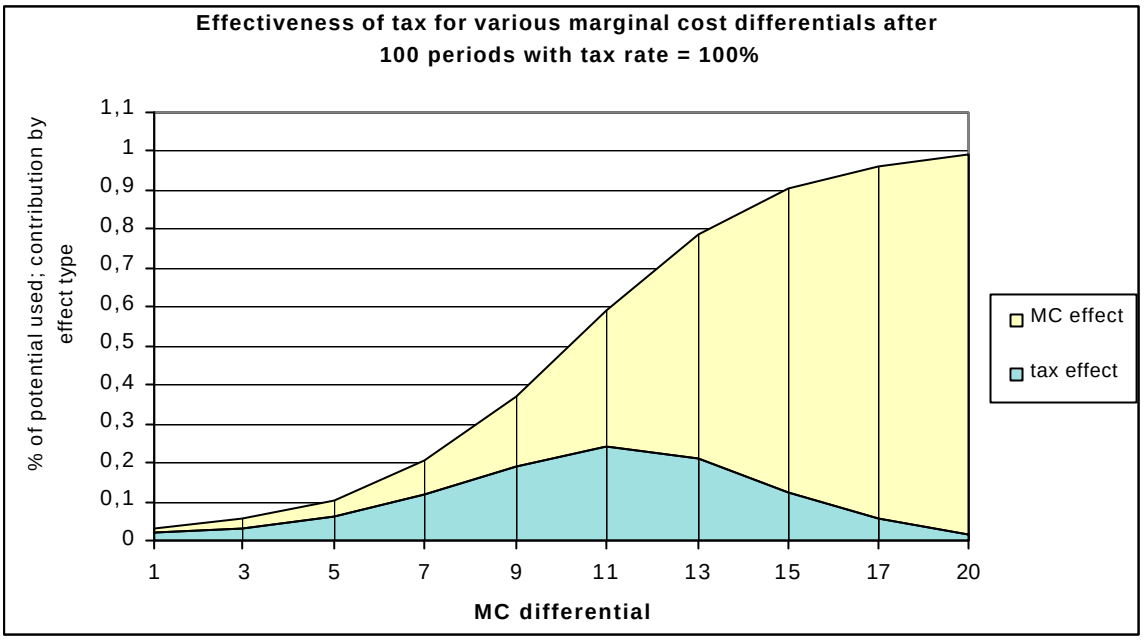

Figure 4. Incremental impact of taxation on penetration of abatement measures for with various initial cost differentials

If there exists a significant potential for abatement at current or just above current price levels of fossil based energy, while this potential is apparently not used (see e.g. Beeldman, 2000; Lehtilä and Tuhkanen, 1999), it starts to be questionable that taxes would suddenly ignite action. Beyond some point actions will be incited, but in case of large differences between theoretical and actual marginal abatement cost there may be a large amount of dead-weight in the taxes. In such situations there must be important other inhibitions active. Setting a standard in such a case will help a great deal to define clearly a market. The possibly limited effect of taxes in case of already existing large potential gains can be illustrated by means of a penetration curve as depicted in figure 4. The penetration is among others explained by the marginal cost differential and the tax level[iv]. Other items are for example the age distribution of the capital stock, as well as uncertainties about key scenario variables in the short to medium run.

Figure 4 shows the ultimate result (after N periods) of a given tax rate, while there are varying degrees of initial (pre-investment) cost-differentials. Initially both taxation and increased cost differential show a growth in contribution to the penetration of an abatement or efficiency measure. Beyond a certain cost differential the tax starts to count less. The exact position of the maximum depends on the specification of the penetration function, but in principle the shapes remain similar. Therefore, knowledge about the transaction cost is not only relevant to investors, but also to the authorities that have to decide about the dosage, sectoral applicability and timing of taxes.

Practical implications

The message of figure 4 is that if ex ante evaluation indicates that price differentials of available alternatives should already have caused a significant penetration of an abatement technology, while the actual penetration is much lower, than levying just (more) tax may have relatively limited effect, while awareness, demonstration (e.g. including a first mover subsidy) may trigger substantial progress in penetration.

A related kind of conclusion was reached in a background study of the Finnish domestic climate programme assessment. The researchers found that further increases of the taxes on motor fuels were relatively ineffective considering the current already high tax on motor fuels (all in all almost 1 Euro/litre gasoline) (Kemppi, Perrels and Lehtilä, 2001). Furthermore, the negative purchasing power effects could be partly compensated by postponing new car purchases and thereby reducing innovation speed in the car stock[v].

It was indicated that it makes more sense to introduce differentiated taxation for the car purchase tax in connection with the agreement between the EU and car makers on the introduction of the so-called 5 litre car. When people buy a car they already make a basic decision on covering a large part of their mobility by car. Therefore a tax revenue neutral differentiation in the purchase tax will speed up penetration of far more efficient cars. However, in case of quick penetration the reduction in fuel sales is significant enough to necessitate a modest fuel tax increase in case total fuel tax revenue is not supposed to diminish. The various ways to raise fuel tax and/or differentiate car purchase tax also demonstrated significant welfare transfers across household types.

As regards social-economic cost assessment the impact of imperfections in the factor markets (biases in prices for capital, labour and, energy and materials) can be taken care of in AGE models, though not in every detail. However imperfections in product markets, such as in construction and real estate markets and consequences of asymmetry, are much harder to tackle. Economic assessment results of policy instruments that (also) target such kind of markets have to be judged carefully.

Other complications in ex ante assessments

Next to the above mentioned imperfections affecting the ability to make precise comparisons between the efficiency of instruments or instrument packages there are the following aspects, which are hard to deal with adequately:

a. long term technology dynamics and its feedback effect on competitiveness of emerging technologies and economic structure
b. ancillary costs and benefits of policies
c. long term changes in the preference set of consumers
d. security of supply (often not operationalised in a sufficiently testable way)

Separate studies that attempt to address these issues, generally hint in the direction of lower cost, because:

- the long term dynamics brought about by technological development are mostly larger than forecast
- there seem to be much more ancillary benefits (local air quality, security of supply, etc.) than costs
- changes in the expenditures of consumers are always judged given the current preference set, since in mainstream models only income and prices affect the expenditure pattern; consequently this approach is for example unable to reproduce the tremendous increase in expenditures on mobile communication or holidays
- switching from fossil fuels to renewables implies usually an increase of indigenous fuel use, which is enhances security of supply

Irrespective the applied assessment method and regardless of concerns concerning the above mentioned inadequacies the following aspects can significantly affect the perceived desirability or feasibility of an instrument:

A. distribution effects
   A.1. between groups
   A.2. interregional
   A.3. international (relocation, trade diversion, leakage, etc.)
B. bureaucratic / organisational permanence
C. insufficient ex post studies and insufficient feedback from ex post to ex ante studies

The relevance of distribution effects shows for example in the reluctance of countries to charge industries or at least energy-intensive industries – at least up to now - full carbon dioxide (or energy) taxes as may be applied to other sectors (services and households). This is typically a matter of a prisoners dilemma, leading competition through policies. If all mutually principal trade partners would impose policies (including tax recycling) with the same cost effects only a generic reduction in demand per sector would result, but that reduction in demand might even be lower than moving the burden relatively strongly to not-intensive sectors, which for example might induce bigger reductions in private consumption. Yet, if the same (sub-optimal) policy would cause substantial welfare transfers within the household sector, its implementation details will be usually reconsidered.

Interregional imbalances can occur in relation to certain heavy industries and mining, which are all sectors that are above average sensitive to climate policy. On the other hand a switch to renewables is often favourable to interregional equity.

Some policy alternatives may cause resistance in the public authority organisation itself. If for example prescriptive measures are exchanged for a Voluntary Agreement including self-financing schemes and mandatory but non-governmental monitoring of performance, the gravity point in policy management may move to an other ministry or section and the total required labour input could be significantly less. Also segmentation between public organisations may cause lack of understanding for policy innovations.

Last but not least ex ante assessment of instruments and measures should strive for much larger input from monitoring data and ex post evaluations. This implies in the first place that virtually all countries have to step up their monitoring and ex post evaluation practices, ensuring completeness, rigorous measurement and possibilities to decompose by influencing factor.

In order to be able to deal with the various kinds of concerns a comprehensive set of evaluation criteria to judge (packages of) instruments preferably includes:

1. Energy or emission savings unit cost (social-economic unit cost)
2. Total potential
3. Direct outlays (investments, elevated use cost, etc.) and resulting private cost-benefit ratio
4. Effects for government budget
5. Distribution effects (significant losses and gains for identifiable groups)
6. Ancillary benefits and costs (e.g. other emissions, public health effects, security of supply, real estate prices, interregional (im)balances, etc.)

7. Certainty of savings achievements and costs
8. Time profile of impact build-up
9. Dependency on organisational, regulatory, managerial and behavioural prerequisites
10. Reversibility and degradability of the measures and the saved amounts
11. Compliance likelihood and enforceability

Criteria 1-6 convey information about the effectiveness and efficiency of the measure. Of these the criteria 1-4 are the core criteria. Distribution effects indicate possible sources of opposition and support and thereby may also give hints of additional equalisation or compensation cost. The criteria 7-11 give information concerning the various kind of risks of non-performance.

Examples of programme results

As a general notion it can be said, that it seems beneficial to redress (e.g. by 'greening the tax system') expenditures to some extent away from energy to other kinds of goods (and sectors) in Finland For example, applying an input-output table shows that the multiplier of the energy sector is 0,09 below the average I/O multiplier (=approx. 1,75). So, other expenditures are about 6% more effective. Other exercises focussing on the marginal taxation rate of various taxes in Finland (income, capital, energy, some other products) demonstrate that shifting taxation to some extent from labour to energy can enhance welfare (Koskela et al, 2000). For the subject of public procurement policies Quirion (2001) arrives at comparable results for France. These observations are closely linked to the so-called double dividend debate. They leave open how exactly this shift should be done, i.e. without causing the unintended effects mentioned in the previous section.

Below a selection of energy and/or climate policies results are presented. The reported results from ex post evaluations are without ancillary benefits and do refer to direct effects and cost-benefit ratios of the implemented measures. Only occasionally macro-economic effects are mentioned in ex post evaluations.

1. *Industrial project investment support* (e.g. demo project)1985-1995.
The resulting cost per unit of saved energy amounted to 2,5 Euro/MWh, which is far below the usual price of saved energy carriers (20 ~ 100 Euro/MWh), meaning that the instrument shows excellent cost-benefit ratios.
The subsidy possibilities are based on project assessment, partly in relation to prior (also supported) RD&D projects. On average the support percentage is approximately 20%. The total number of projects and the volume of support was comparatively small. The very high cost-benefit ratio suggests that only the cream of the cake has been skimmed, leaving the potential to incite social-economically beneficial saving investments probably under-utilised. There is a tendency to try to keep down free-riding in subsidy schemes. It has not been assessed to what extent the subsidised projects invoked similar investments in the same or other sectors. More explicit use of market transformation tools may enhance the multiplication effect of subsidised (demo)projects.

2. *Energy audits* (mostly in commercial buildings, but extension to industry considered).

This appears also to be a very good rating instrument. The cost per unit of saved energy are 7 Euro/MWh (heating) and 18 Euro/MWh for electricity.
The instruments means that it the cost of the scan are subsidised, whereas the energy agency MOTIVA has been actively marketing the scan for some years. In recent years the number of audits fell back. Since the importance of this instrument has been recognised it gets renewed attention in the National Climate Strategy (domestic measures), also in connection with voluntary agreements.

Mäenpää in Jeeninga (1999) shows that energy scans have been also beneficial for the macro economy, notably due to the strong multiplier effects of the saved costs in the industry.

3. *Home renovation programmes* (1980-1996)
From the results a cost per unit of saved energy of 40-55 Euro/MWh can be inferred, applying an effective lifetime of the saving measures of around 20 years. This amounts to 1 – 1,5 x user price of saved energy carriers.
The programme includes regulation on attainable standards plus a subsidy programme.

When ancillary benefits, labour market effects and consumer preference reassessment are taken into account even this programme may become macro-economically attractive. Furthermore, in upcoming years energy end-use prices are likely to rise due to increased CO_2 taxation.

Sources examples 1-3: Kasanen et al. (1997); Jeeninga et al (1999);Capros et al (2000); Wade and Warren (2001).

4. *Voluntary Agreements.*
It is mostly quite difficult to come up with fairly precise performance figures of voluntary agreements. The Finnish agreements have a low degree of commitment enforcement and extensive monitoring is not a common practice (yet). Generally the Danish agreements are regarded as being most precise and committing, including reporting obligations. The Dutch system of voluntary agreements is very extensive, covering most economic sectors and also implying sector wide application. Korevaar et al (1997) however point at critical issues regarding the attributability of impacts to (elements of) voluntary agreements.

Starzer (2001) points at the significance of blending a voluntary agreement to national/local possibilities, needs and customs. For example, monitoring obligations and sector wide coverage seem to be effectiveness improving qualities of a VA. The way parties reach an understanding about this and the implementation time will nevertheless vary from country to country.

For public authorities that want to engage in voluntary agreements the asymmetry in information is often a problem. Especially in the case of industry the sector itself has often the most detailed (though not perfect) information about what can be changed and when, what the total potential is, and what kind of synergies could be achieved. In non-industrial sectors the asymmetry may be smaller or absent. As a consequence there is the evident risk that agreements in the industry include lower targets than optimal, whereas non-industrial sectors may even end up with higher targets than optimal.

Chidiak (1999) illustrates that a kind of carrot-and-stick system in which voluntary agreed commitments can be traded for carbon tax reduction (or exemption) could lead to effectively more emission reduction against lower social-economic cost. That idea could be fine tuned further by introducing auctions for reduction plans connected to targeted subsidies and/or tax reduction.

Sources: Kasanen et al (1997), Korevaar et al (1997), Hansen and Larsen (1999), Chidiak (1999), Starzer (2001).

5. *Ex ante evaluation on CO_2 taxation with tax recycling* (Kemppi and Lehtilä 2001):
The CO_2 taxation with tax recycling is arranged such that government budget balance is preserved. According to the simulations the scheme would create 0,2 % loss in GDP compared to the 2010 baseline[vi]. Interesting is that the needed tax level (and hence the impact distribution over sectors) is rather sensitive for the amount of available import electricity as well as for the option to add nuclear power, whereas the eventual impacts on GDP differ only slightly. The question is however, what happens if:

- on the one hand imperfectly informed markets and unfortunate vintage distributions in the industrial capital stock are real obstacles in some sectors (which is very likely)
- on the other hand taxation is embedded in market transformation policy, including significant transaction cost reducing measures in a competitive performance guidance setting

Concluding observations

Apparently the construction of policy packages requires common sense as much as it needs input from various sciences. Also tuning to local circumstances is essential for making policies work. Effectiveness and efficiency get better the more policy making is regarded as an ongoing process, in which the cycle 'ex ante evaluation – monitoring – ex post evaluation – ex ante 2 ..' plays an important role. In order to improve ex ante assessments it will be very beneficial to make rigorous ex post evaluations a default practice.

For markets in which the purchase cost of the energy are evident for the user and where the user has discretion to adapt use patterns as well as technology, price related instruments (taxation, tradable permits) prove to be an effective and efficient instrument. Therefore – in principle – it is effective and efficient to add a carbon tax to carbon containing energy carriers, provided the excess revenues (net of climate policy subsidies) are recycled to the tax payers by lowering other taxes for companies and households. The shaping of the recycling and the availability of targeted subsidy programmes can be used to convince reluctant sectors. For raising the awareness in the market and organising monitoring as well as for a proper framing of the tax recycling and targeted (technology) subsidy programmes voluntary agreements would be helpful.

In case a tax scheme risks to hurt certain sectors or regions significantly, a compensating (transformation) programme will often be better than severely watering down the tax scheme. In case of competitiveness issues international co-ordination to prevent competition through policies is called for as well.

There are plenty of markets in which the purchase cost of energy and the eventual use are not closely connected, neither can the user seriously affect energy technology choice. In these circumstances more extensive guidance is called for. Price oriented measures are still relevant, but need much more support from performance standards, demonstration projects, information and education, integration all stakeholders in comprehensive product chains (design – make – sell – use – dispose – recycle – etc.). Furthermore, in those cases not (only) the price of the fuel counts but instead the price of machinery or appliances can be decisive. Differentiating tax/subsidy schemes and market introduction programmes using the concept of experience curves (IEA, 2000) are effective and over a somewhat longer time span also efficient.

Passenger transport is also an area where responsiveness to fuel prices is limited, even though (or just because) people can choose a smaller car or switch more frequently to public transport. Transportation behaviour is very much embedded in complex temporally and spatially bounded networks and patterns of obligations and habits (e.g. Coffey, 2001; Bratt and Persson, 2001). The shadow cost of change are therefore often much higher than the extra cost due to elevated fuel tax. Next to dramatic decreases in average fuel use of the car fleet, this also requires changes in spatial planning and in the societal organisation of time.

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*) ECEEE 93, 95, 97, 99 proceedings are downloadable from http://www.eceee.org/, the 2001 proceedings are downloadable for non-members in Spring 2002.
Also the IEA web-sites http://www.iea.org/ and http://dsm.iea.org/ contain valuable material.

End notes

[i] . There is also the long term integrated assessment approach, in which damage assessment can be taken into account as well as alternative ways to (gradually) include non-Annex 1 countries. This is important for future commitment periods, but I assume it of less practical relevance for climate policy *implementation* up to 2010.

[ii] . Compensation can be made by lowering company taxes or employers' social security contributions for companies and lowering income taxes for households. There are disputes going on to what extent revenues can be earmarked, without loosing too much of the positive effect of compensation.

[iii] . There are several examples of introducing uncertainty (imperfect foresight) in models, for example in the MARKAL model. Yet, in that case players in the same market are still *equally* uninformed.

[iv]. This assessment methodology is not based on energy systems or macro-economic models, but uses penetration or dynamic substitution functions (Van Harmelen and Uyterlinde, 1998). It allows for flexibility for case specific variables. Though it is single measure(type) oriented it enables to assess the effectiveness of the policy context. The method benefits well from monitoring and ex post evaluations.

[v] . Regardless of a slowdown of new car purchases higher fuel prices will of course be a stimulus for the purchase of more fuel efficient cars. However, the income elasticity with respect to preferred car size often more than wipes out this effect.

[vi] . The study also assumes no disadvantageous foreign (climate) policy effects on essential export markets for Finnish products (it would aggravate the GDP loss) and neglecting possible benefits from reinforced export demand of abatement technology due to foreign climate policies (it would diminish the GDP loss). The currently applied ceiling in the amount of payable carbon tax (at company level) is assumed to remain at the level of 3,7% of value added.