Two approaches to pricing pollution

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Preface

Most people agree that we need to solve our major environmental problems. The question is which methods are most effective and politically viable and will they work in practice?

This project aimed to develop a foundation for better decision-making and policies through increasing the understanding of the opportunities and drawbacks of various approaches to setting a price on pollutant emissions.

This report gives political leaders the opportunity to take advantage of the knowledge available in the area today by presenting and analysing comparisons of two approaches from different disciplines. The target group includes political representatives, government officials, consumers and environmental agency officials as well as other stakeholders – primarily in the Nordic region.

One of the most common methods today is the Cap and Trade approach, currently used for trading carbon emissions permits in the EU-ETS. The way this method is implemented in the EU-ETS, mainly due to political restrictions and obstacles, has been criticized by many in light of the falling prices on emission permits in this system contrary to the obvious need for more powerful economic driving forces.

This report compares the Cap and Trade method with an alternative method, the Flexible Fee Mechanism. The Flexible Fee Mechanism was created as a response to political and other practical obstacles often preventing the efficient application of other methods. The main focus of the Flexible Fee Mechanism is the levying of a fee at the point where a pollution-inducing product enters the economy. The fee is then raised sufficiently (and sufficiently often) to effectively stimulate the transformation of the economy in a sustainable direction. At the same time, the revenue from the fee is directed back into the economy to stimulate alternatives, demand and employment.

Earlier studies, headed by adjunct professor Magnus Enell, showed that the Flexible Fee Mechanism, also known as the Höglund Mechanism, opens up new alternatives concerning the political and practical implementation of economic and environmental control mechanisms.

That report was published by the Nordic Council of Ministers Working Group for Sustainable Consumption and Production (SCP). This study is a continuation based on the conclusions in that report.

Flexible Fees work by:

- Levying a Fee which is sufficiently high and adjusted sufficiently often for a Fee – induced Futures Market to emerge.
- Letting the Futures Market and other hedging and insurance instruments indicate the price (the average abatement cost) which can be levied without harming the economy.
- Securing a repayment of a sufficiently large fraction of the revenue from the Fee so that a majority of voters will clearly benefit from the Flexible Fee Mechanism and investors will put money into environmentally sustainable (cheaper) alternatives.

These three parts or components are all essential to the mechanism. If one or more of them are lacking, then the viability and economic control function of the mechanism will be impaired.

Due to circumstances and limitations, only the first part or component of the Flexible Fee Mechanism was studied and to reduce complexity the study kept to a more high level comparison of the approaches in general with reference to the European ETS scheme.

The original assignment called for a comparison of the practical application of the two approaches to nitrogen and phosphorus. One factor that was possibly under-estimated in framing the assignment was that each approach is aimed at different objectives, views pollution differently and handles the revenue from the fee differently. Furthermore, the two approaches view the role of the market differently, as well as the role of economic incentives in the building of political support.

That the study became narrower than intended, however, does not diminish the importance of this report. On the contrary, it makes it even more important as a source and starting point for further discussion and research, which, based on what arises from this report, is urgently needed.

This *“Two Approaches to Pricing Pollution”* project was launched by the Working Group for SCP (HKP) and conducted in collaboration with the Working Group on Environment and Economy (MEG) under the Nordic Council of Ministers.

The project was carried out by a consortium with COWI as lead in co-operation with FORES and VATT.

The project has been carried out by:

- Christina van Breugel, Project Manager, COWI
- Mattias Enggaard, COWI
- Jes Erik Jessen, COWI
- Ulrika Stavlöt, FORES
- Christopher Sköld, FORES
- Elina Berghäll, QA responsible, VATT.

The steering group appointed for the project consisted of:

- Stefan Nordin, Swedish Agency for Economic and Regional Growth
- Fredrik Granath, Swedish Environmental Protection Agency
- Øyvind Lone, Norwegian Ministry of the Environment

During the project, a number of stakeholders were interviewed, and we would like to take this opportunity to thank the following contributors:

- Anders Höglund and Stephen Hinton, The Swedish Sustainable Economy Foundation
- Jørgen Schou, Danish Environmental Protection Agency
- Jørgen Birk Mortensen, University of Copenhagen
- Jens Holger Helbo Hansen and Mette Gravesen, Danish Ministry of Taxation
- And the many others who have been willing to discuss and develop the topic of this report.

The project was undertaken from October 2012 to January 2013.

Sigurbjörg Saemundsdóttir

Chair of the Nordic SCP Working group (HKP gruppen)
Ministry for the Environment, Iceland

Summary

The report analyses economic mechanism for pricing pollution in a practical setting.

Based on a set of criteria (efficiency, transaction cost, acceptability and others) the analysis compares of proposed flexible emission fees and tradable emission permits. The aim is to clarify advantages and challenges of the respective mechanisms that are important in the practical process of the regulator deciding what regulation to impose on polluters.

Tradable emission permits are well described and broadly used. However, the application has not been without difficulties, which is the current case for the permits-based European Emission Trading System for CO₂. In the analysis, tradable emission permits are included as a mean to highlight differentiators of the flexible emission fee mechanism.

The functioning of the flexible emission fee concentrates around an independent expert group that sets a fee on emissions and varies the fee often to ensure proper reductions emissions. In consequence, the polluters will insulate themselves against the varying fee on a futures market. The price of futures reflects the market expectations for tomorrow's fee based on e.g. development in marginal abatement costs due to technological change. Information feedback from the futures market can be used by the expert group to adjust the fee.

The novelties of flexible emission fees include very frequent adjustments of fee, an independent expert group with operational freedom to manage the mechanism and the introduction of sufficient volatility in order to produce a new stable equilibrium (via futures markets). In addition, the price on pollution is only indirect as the flexible emission fee is meant to reflect marginal abatement costs, which is contrary to the predominant approach of setting the emission price equal to environmental damage costs.

These novel elements could to some extent be adopted by other types of regulation and may correspond more or less to the paradigms of today's environmental regulation. Still, key questions remain unanswered: are the benefits of flexibility and induced stability by means of a volatile fee greater than costs incurred? This question requires a formal economic analysis that can test assumptions.

The flexible emission fees have been described both with and without a specified environmental target. The implications of this range from a question of cost effectiveness – where different mechanisms can be assessed on their ability to reach a target at lowest cost – to a fundamentally different perspective on environmental regulation than the prevailing. If there is no specified target the flexible emission fee will in effect drive emissions down at a rate comparable to the change in polluters' abatement costs, but without explicit consideration of environmental damage costs. This can potentially minimize abatement costs, but not optimize costs and benefits of reaching an environmental target.

On the question of where the mechanism has its potential strengths, consideration in the analysis are with characteristics as shown in the table below.

Table 1. Potentially the flexible emission fee has strengths in cases with these four characteristics

Where high levels of low cost information on effects are available as many adjustments requires much information.
Where objectives are long term and where environmental damages are small and minimization of abatement costs is the top priority.
Where the typical alternative is a ban and transaction costs are not prohibitive (e.g. very sensitive environmental challenges where regular monitoring and adjustments by an expert group are necessary to make sure emissions stay within narrow thresholds).
Where there is a time lag between the political decision of the overall environmental legislative framework and the actual setting of targets (e.g. policies that originates from the EU and where the Member States subsequently are to design the national implementation) the flexible emission fee would allow regulators to quickly to initiate a fee without a specified target for the relevant emission, substance or resource and only later determine the national target with a knowledge of the cost of abatement which have been reflected at the futures market.

The flexible emission fee is presented as an alternative to current environmental legislation. A change of regime is suggested that will favour consumers through repayment of fee revenues, reduce polluters' abatement costs, and phase out unwanted substances as well as promote recycling. In this study, however, the current environmental regulation based on national and international legislation and the corresponding set of policies is unchanged and flexible emission fees is regarded as a stand-alone mechanism comparable to others such as taxes, command and control etc. This will allow an analysis of the use of the mechanism within the limits of the current regulation and to compare the mechanism with others being implemented.

This is also the case in relation to repayment of fee revenues to consumers that is proposed as part of flexible emission fees. The present study argues that the flexible emission fee remains an economic mecha-

nism for environmental regulation comparable to other which has analogue options for repayment.

It is recommended that further development and communication of the mechanism focuses on the economic core and not the broader motivations for environmental regulation nor the spending of revenue. Only this way can the mechanism win broader acceptance among regulators. In addition, the economic reasoning has to be substantiated and tested and an obvious next step is contact to academia and publication in peer-reviewed economic journal.

Definitions

Actions

Polluter's actions that affect emission levels, e.g. input substitution and technology adaptation.

Flexible emission fees

An expert group sets a fee on emissions and adjusts the fee often to ensure proper reductions in emissions. The polluters will hedge themselves against the varying fee on a futures market. The price of futures reflects the market expectations to tomorrow's fee based on, e.g., technological and environmental trends; this information can be used by the expert group to adjust the fee. Revenue is suggested to be redistributed to consumers.

Futures market

A derivatives market where future expectations to the flexible emission fee can be traded. It is assumed to emerge if fee fluctuates sufficiently and enables polluters to hedge against this volatility.

Mechanisms

Regulator's economic-based policies to combat pollution.

Polluter

The entity that is the source of the targeted emission and is included under the mechanism.

Regulator

The public authority that governs the mechanism, sets environmental targets, monitors and enforces legislation.

Tradable emission permits

A mechanism where a fixed number of emission permits are auctioned or given to polluters that can choose to trade permits on the market, use permits when emitting or abate emissions. The number of permits can gradually decrease over time.

1. Introduction

In an economic system where finite resources (in the long run) are being depleted – rather than recycled – and harmful substances are discharged/emitted beyond sustainable levels through economic activities and thereby in the long term undermining the system, it becomes increasingly evident that this development calls for the application of mechanisms to support sustainable ways of production and consumption. Such mechanisms to be applied should be environmentally and economically effective as well as socially and politically acceptable. In our view, the overall background for the present project “... aimed at developing a better basis for policy on sustainable production and consumption through developing practical pricing approaches to pollution.” Policy action must be seen from the perspective of both consumers and industries as both are part of causes, solutions and will bear the positive and negative consequences of environmental regulation.

The present project should be considered as a follow-up to the recent report *“Flexible emission fees: an incentive for driving pollution reduction and sustainable production and consumption”* released by the Nordic Council of Ministers,¹ which sets out five areas for further exploration, especially in relation to the practical application of flexible emission fees compared with a cap and trade (tradable emission permits):

- A rigorous comparison between the two main pricing approaches: cap and trade vs. flexible emission fees with a repayment mechanism.
- An investigation of the conditions necessary for the emergence of flexible emission fees futures markets.

¹ According to the call for tenders, the report concludes “... that by increasing fees until the market responds and by redistributing a sufficient fraction of the income from the fees, to make the solution politically and democratically viable, market forces may well be able to respond by seizing this opportunity to supply relatively cheaper, non-polluting goods and services whilst older, more polluting alternatives retain financial stability during their phase-out period. ... The report is optimistic that both growth and environmental goals can be reconciled if fees are managed in this way.”

- A study of the repayment mechanism and its effect on the political and democratic acceptance of sufficiently high fees to achieve sustainability.
- Looking at a range of pollutants that accumulate in nature to include those that are abundantly available, i.e. nitrogen, recyclable, i.e. phosphorus and non-renewable, i.e. carbon dioxide from burning fossil fuels.
- Comparing the two approaches both in general and for the same pollutants to generate valuable knowledge, perspective and understanding.

The purpose of this project is therefore to investigate and compare effective design and implementation of the practical application with the concrete environmental challenges of two main approaches to pollution pricing, namely a flexible emission fee with a repayment mechanism and a tradable emission permit mechanism. In doing so, the focus should be on the advantages and disadvantages of the various approaches to pricing pollution in a practical setting, thus contributing to enhancing the basis for decision-making and political solutions.

2. Description of the project – methodology

This report will further the discussion of flexible emission fees by means of a comparison with tradable emission permits. Focus will be on the practical applicability of the mechanism discussed upon theoretical criteria.

The analysis explores the usefulness of flexible emission fees as an economic policy instrument for pricing pollution, and it can be seen as a step towards testing and maturing the idea of flexible emission fees. The flexible emission fee can be used as a policy instrument in line with other market-based instruments. The analysis will explore the similarities and differences compared with other instruments, especially cap and trade.

The overall aim of the flexible emission fee is to set the correct price on pollution, thereby achieving a fair payment from the users of the environment.

A Nordic perspective is maintained in the establishment of cases. The analysis does not carry out any formal analysis, modelling nor consider legal aspects. It is outside of the scope of the analysis to examine legal obstacles and related considerations. The analysis will be based on the interviews conducted during the project phases and the theoretical considerations already made in previous analyses.

2.1 Analytical focus

Flexible emission fee (FEF) is presented as both an economic mechanism and as an element in shifting our economic system towards a sustainable path.

The Swedish Sustainable Economy Foundation contextualises the mechanism in its argumentation, which covers “closing element cycles to promote full recycling,” “cradle to cradle” and “repayment of revenues directly to citizens in order to create public acceptance of higher retail prices resulting from a game changing fee.” In this analysis, the scope is narrower and the analytical focus is on flexible emission fees as an economic mechanism vis-a-vis tradable emission permits (TEP). Both mechanisms are highly relevant to discuss in a broader context, but to a

large extent they coincide in their ability to tackle environmental concerns and generate revenue that can be repaid.

The inspiration for the mechanism is found in control engineering where engines can be designed to improve the congestion by getting continuously feedback. The FEF (flexible emission fee) differentiates itself from the tradable emission permits by influencing the price on the market instead of the quantity.

2.1.1 *Where do the mechanisms differ: from input to emission?*

To guide the reader in the proceeding analysis, we will give a few comments on the report's overall distinction between the two mechanisms.

In the descriptions of FEF (see section 3.3), it is presented as an approach to putting a price on pollution and correcting market failure, but also as part of a political ambition to transform society (a closed, circular economy based on recycling of resources) and to redistribute fee revenue to consumers.

This compares to TEP which is part of mainstream environmental regulation and economics and where distinction is made between the "economic core" of the mechanism and its role in politics and economic policy.

However, as the table shows this distinction is not necessarily a challenge when comparing FEF and TEP. TEP can in many ways be parallel to FEF depending on the actual design and context of the mechanism application. In consequence, this report aims at highlighting the points where the mechanisms differ and the potential advantages and drawbacks of these differences.

In the view of this report's authors, the innovative elements of FEF lie within the functioning of the mechanism itself. The emissions to which FEF can be applied or how revenue is spent are very much parallel to TEP and are therefore given less attention in this report.

Table 2. Some differences and similarities between the flexible emission fees (FEF) and tradable emission permits (TEP), respectively

Topic	FEF	TEP
Type of emission	Can be applied to a range of emissions (or inputs) both up- and downstream in the value chain	
Set quantity or fee	Sets an initial fee that is changed reflecting market signals (but also on ambition for future emission quantity)	Sets a future emission quantity based on political choice
Market correction	Puts a price on pollution	
Adjustments	Based on new info, the price can be adjusted with small time intervals. Adjustment decided by independent expert group	Quantities adjusted after trading period, which in principle can be long or short. Adjustment decided politically or other policy makers (could also be an independent expert group)
Use revenue	Redistribute to consumers	Redistribution to polluters, via public budgets or directly to consumers*

*Cases where TEP uses grandfathering of permits (permits are given to polluters for free), no revenue will be generated and nothing redistributed. The analytical focus in this report is primarily on the mechanisms, narrowly speaking. This line of thought is illustrated below.

Figure 1. Analytical focus on mechanisms rather than broader context

2.1.2 What is implied by “practical”?

In this context, the term practical aims at the matters that need to be dealt with when applying economic regulation to environmental problems. This involves questions such as:

- What is the right level of regulation?
- Who will bear the cost?
- How can the administration, enforcement and monitoring be designed?

However, in the case of FEF and TEP a very high degree of both general definitions and case specifications has to be in place before these practical questions can be subject to analysis.

In the view of this report’s authors, the detailed information on FEF is not available to an extent that allows answering of practical questions such as those above. A crude illustration of the knowledge base for FEF shows the mechanism can be further developed and studied on various levels. In comparison, TEP has been subject to much scientific scrutiny and application both to emissions and to other matters. Nonetheless, TEP has given many challenges when applied (as evident in the present debate on the EU Emission Trading System) and is still being developed.

Figure 2. Crude illustration of levels of knowledge development for flexible emission fees (FEF) and tradable emission permits (TEP), respectively

In the absence of comparable information, comparing the two mechanisms is attached with difficulties both in general and when applied to specific cases. Thus, a comparison of practical elements including administrative costs, transaction cost, environmental and economic efficiency is presently not feasible.

This report approaches its title – “practical approaches to pricing pollution” – in a pragmatic way. In the following chapters, the report discusses and applies theory to components of practical application of the two mechanisms. At this stage, the outcome is recommendations for topics that need to be developed further in order to practically apply FEF.

2.2 Approach

The method used in this analysis contains the following steps:

- Defining the criteria necessary for assessing and comparing different market-based instruments.
- Assessing flexible emission fees and comparing them with the cap and trade from a theoretical perspective.
- Testing the practical possibilities of the instrument through interviews.

The report will first set up a number of general criteria for discussing efficiency requirements of economic instruments. The criteria are general and could be applied to any kind of instrument. Next, a short introduction to flexible emission fees and tradable emission permits will be given. Finally, the instruments will be combined with the established criteria – both at the general level but also in relation to specific cases.

The overall analytical approach is illustrated in the figure below.

Figure 3. Analytical approach

Alongside the comparison of the two mechanisms, a general introduction is given to the options for spending the *revenue* that the fees or auctioning of emission permits generate. Basically, revenues can be regarded as contributions to government budgets or be repaid to either companies or consumers; nonetheless, the choice of how to spend revenues can have an effect on the political acceptance of the policy suggested. The two instruments together with many other market-based instruments are parallel in this respect, and the topic will be presented as an additional perspective in a separate section.

The analysis combines existing knowledge from literature and experts into an analytical framework established to discuss theoretical and practical aspects of the flexible emission fees. As no application of flexible emission fees exists, the analysis will remain hypothetical but the framework allows a discussion of opportunities and drawbacks of potential applications. Interviews with practitioners will support the evidence to conclude on these issues.

The discussion proceeds at two levels; a *general* evaluation of the instruments characteristics and requirements for economic efficiency and a *case-based* evaluation. The analysis establishes analytical cases for various pollutions, market characteristics and stakeholders involved upon which the instruments are applied. This allows a practically oriented but hypothetical discussion of practical pollution pricing under varying circumstances.

To qualify the discussion of practical application of the instruments, the project has drawn upon expert interviews. The interviews have been conducted in order to gather information, test analytical frameworks and arguments.

The results are a synthesis of the general and case analyses shedding light on the two practical approaches to pricing pollution.

2.3 Criteria for economic efficiency

The optimal mechanism would be one that ensures target fulfilment within a specified timeframe,² by choosing the actions that can be implemented at the lowest possible cost (while stimulating development of actions with even lower marginal reduction costs), and without causing adverse distributional effects deemed to be political and democratic unacceptable. Ideally, such an optimal mechanism should at the same time be characterised by full and certain knowledge of the interplay between pressure and impact³ as well as actions and their cost, and by incurring no kinds of transaction costs.

Although no mechanism fulfils this ideal, it seems to be a good point of departure for assessing the features and practical applicability of different mechanisms.

Thus, for comparing the practical applicability (to counter a specific pollution problem) of the flexible fees⁴ mechanism against the more well-known cap-and-trade mechanism, i.e. comparison of the two different main approaches to “pricing pollution”, the following four main categories of criteria could be developed and applied:

- Efficiency.
- Acceptability.
- Uncertainty.
- Transaction costs.

These four main categories of criteria will be defined below.

² Ideally, such target should be set as to reflect equilibrium where the marginal abatement cost equals the marginal environmental cost, to be socially cost effective.

³ This terminology refers to the DPSIR framework used by the European Environment Agency (EEA), to structure thinking about the interplay between the environment and socio-economic activities. DPSIR stands for: Driving forces – Pressures – State – Impact – Responses. The DPSIR framework represents a systems analysis view:- social and economic developments exert pressure on the environment and, as a consequence, the state of the environment changes. This leads to impacts on e.g. human health, ecosystems and materials that may elicit a societal response that feeds back on the driving forces, on the pressures or on the state or impacts directly, through adaptation or curative action.

⁴ According to literature, it is important to distinguish between “tax” and “fee”: A tax generates general government revenue to be used in principle for general purposes, while a fee is revenue neutral to government as the revenue generated should be re-distributed back to the sectors where the fee is levied. The classic example is a fee levied on pollution, that is re-distributed back to the sectors where the fee is levied to e.g. stimulate the development and use of cleaner technologies.

2.3.1 *Effectiveness and efficiency*

For analytical purposes, efficiency is divided into various subcategories:

- *Environmental effectiveness* of mechanisms ensures certainty of target fulfilment (desired level of pollution reduction) – within a given time frame. By environmental efficiency, we understand the potential of the mechanism for reaching the desired level of pollution reduction targeted – within the desired time frame.
- *Economic efficiency* of mechanisms ensures pollution reduction at the lowest cost and largest environmental gains to society. By cost effectiveness of a mechanism, we understand the potential/ability of the mechanism to reach a given level of pollution reduction at the lowest possible cost (to society) – or alternatively to achieve the highest possible level of pollution reduction at a given cost (to society) – through its potential to provide incentives for implementing the “cheapest” actions, i.e. the actions that can be implemented at the lowest possible cost.⁵
- *Dynamical efficiency* of mechanisms ensures lowering of marginal reduction cost over time. By dynamical efficiency, we understand the potential of the mechanism to provide incentives for the development of new actions over time, e.g. by stimulating technological development that can reduce pollution at lower cost than hitherto, thus lowering the overall marginal reduction costs over time.
- *Distributional efficiency* or efficiency of redistribution of revenue, ensures that the revenue is redistributed efficiently. By efficiency of redistribution of revenue, we understand the redistribution of revenue in a way that achieves the highest possible level of pollution reduction – through its potential to provide incentives for pollution reduction – e.g. as direct subsidies to stimulate development of environmental technology by the industry, or e.g. in a way to stimulate environmentally sound spending by the public.
- *Predictability/stability* of mechanisms ensures predictability about cost of pollution and/or alternative cost of emissions reduction. By predictability, we thus understand predictability about cost of pollution and/or alternative cost of emissions reduction that is of importance to polluters in deciding on their investments.

⁵ Transaction costs not included.

2.3.2 *Acceptability*

Acceptability ensures avoidance of adverse distributional effects deemed to be politically and democratically unacceptable. We will distinguish between two main categories of acceptability:

- *Acceptability of division of burdens*, ensures that the imposition of costs is politically and democratically acceptable. Thus, by acceptability we understand the imposition of costs, which is acceptable, politically and democratic, in the sense that it affects pollution reduction without leading to (political and democratic) unacceptable and/or adverse effects on e.g. business sectors operating in markets characterised by strong international competition (from competitors in other countries or regions not facing such costs).⁶ Another example of such unacceptable and/or adverse effects could relate to placing too heavy economic burdens on low-income groups. Who ultimately bears the costs of pollution reduction will thus be of importance to the degree of political and democratic acceptance of the mechanism.
- *Acceptability of redistribution of revenue*, ensures that the redistribution of revenue is political and democratic acceptable. I.e., that the revenue is redistributed in a way that is perceived as acceptable or even to promote acceptability – whether this would be achieved by redistribution of the revenue e.g. as direct subsidies to stimulate development of environmental technology by the industry, or e.g. as a general refund to compensate for the specific fee imposed and/or stimulate spending. Thus, the redistribution of revenue will clearly also be of importance to the degree of political and democratic acceptance of the mechanism.

⁶ This could ultimately lead to increased pollution if home market production (one way or another) is relocated to another country or region without regulation – especially in the case of transboundary pollution.

2.3.3 *Uncertainty*

Uncertainty and/or (lack of) information, hereunder the interplay between the three major types of uncertainty defined below:

1. *Environmental (or scientific) uncertainty* concerns uncertainty about the connection between driving forces (e.g. economic activity) and pressures (e.g. discharge/emissions of pollutants) as well as uncertainty about the connection between pressures and state/impacts (i.e. environmental effect), hereunder natural variations (in biological, geological, chemical and physical conditions of the recipients) – and thus uncertainty about the actual effect of implementing specific actions.
2. *Economic uncertainty* concerns uncertainty about the costs of pollution reduction by implementation of specific actions, including informational asymmetry about actual costs between “regulator” and “polluter”, where the latter often possesses the best information about costs.
3. *Technological uncertainty* concerns uncertainty about the technological ability/capacity of a specific action for pollution reduction – that is of major relevance not least when implementing (almost) unproven technologies.

2.3.4 *Transaction costs*

Transaction costs of applying the mechanism, including *informational* transaction costs that concern the regulating authority’s costs of communicating necessary information about the mechanism to relevant players, i.e. “polluters”, as well as these players’ costs of obtaining and processing information on the mechanism and its requirements.

- *Administrative (administrational)* transaction costs that concern the administrative costs of the regulating authority responsible for implementing and enforcing the mechanism, as well as the administrative costs to those players targeted by the mechanism. The distribution of costs between the public and private sector and the magnitude of costs to regulating authority and players, depend among other things on the degree to which the mechanism differentiates itself according to certain environmental criteria, or the polluters costs of trading emission permits or futures contracts and/or costs to the regulating authority of e.g. providing a platform for trading emission permits or futures contracts.

- *Monitoring* (transaction) costs concern the costs of monitoring the state/condition of the environment, as well as costs of monitoring compliance with the regulating authority's requirements. The intensity of monitoring of compliance will ultimately be of importance to the effectiveness of the mechanism.
- *Juridical* transaction costs that concern the costs of the parties' involvement/engagement in legal disputes when monitoring has shown lack of compliance by one (or more) of the players, or alternatively when one (or more) of the players claim to be treated unjust.

The criteria are applied to the analysis of the mechanism in section 4.

3. Economic instruments for pricing pollution

3.1 Introduction

The purpose of this analysis is to evaluate approaches to setting a price on pollution. Environmental legislation is introduced to protect the environment, create incentives to develop new technologies, create national strongholds and implement the polluter pays principle (PPP).

The price on pollution expresses the cost and benefits that are connected with the change of behaviour or action according to the objective and belonging target of the environmental policy. This includes the valuation of the externalities. These externalities are seldom traded on a market and need to be assessed by using valuation methods which are likely to be uncertain.

The second-best alternative is to estimate or reveal the avoidance cost or, in other words, the abatement cost of reducing emissions. This can be done through gathering information directly from companies or be revealed as a willingness to pay at the market place. The most pragmatic way to estimate or determine the price on the pollution is through the creation of a market. Two different approaches to creation of markets will be investigated in the following.

3.1.1 *The two mechanisms*

This analysis operates with two mechanisms: the flexible emission fee and the tradable emission permits.

- *Tradable emission permits*: A mechanism where a fixed number of emission permits are auctioned or given to polluters that can choose to trade permits on the market, use permits when emitting or abate emissions. The number of permits can gradually decrease over time. The permits are also traded on a market where the prices on the permits express the expected future abatement costs. In that way, the market is a market place for futures.

- *Flexible emission fees*: An expert group sets a fee on emissions and adjusts the fee often to ensure proper reductions emissions. The polluters will hedge themselves against the varying fee on a futures market. The price of futures reflects the market expectations to tomorrow's fee based on, e.g., technological and environmental trends; this information can be used by the expert group to adjust the fee.

Tradable emission permits are a well described mechanism with many practical applications. Flexible emission fees have been the topic of a number of policy reports, but have not been applied to date. The two mechanisms are described in the following.

3.2 Tradable emission permits

An emission permits market is an economic volume-based policy instrument⁷ with the primary aim to achieve an environmental objective at the lowest cost possible for its participants. Compared to an emission tax, a permit market is particularly effective when the amount of emissions is seen as important and there is a risk of reaching a critical tipping point.

In an emission permits market, the quantity of emissions is directly controlled. Emitters included in the system eventually have to cover their emissions by a corresponding number of permits. In case of excess emissions, participants need to offset their excess by acquiring permits from other sources that are able and willing to emit below their established share of permits. A company in need of more credits can purchase them on the market. Conversely, a company that has a surplus of credits can sell the excess. The permit price therefore reflects the scarcity of the right to emit, set by the agreed permit volume, which in turn depends on the stringency of the environmental policy. This is the most common feature of an emission permit market; the "cap-and-trade". Policymakers choose a cap of how much emission is allowed, and within that cap, the right to pollute is traded among the market's participants. The trade is conducted with emission permits, which are controlled and certified by an administrative authority. In that way, the amount of emission given by one permit will be given a market price, thus creating economic in-

⁷ In contrast to a price-based instrument such as a tax, where price is fixed but the level of emissions are not.

centives to decrease emissions by putting an extra cost into investment and production decisions.

The cost of reducing green house gases emissions varies significantly within different sectors but if the market works well, the abatement cost will be reduced as the various sectors and participants are exposed to the same marginal cost of emitting greenhouse gases. This enables the achievement of the desired emissions reductions at the lowest cost. In this way, permit markets create a cost-efficient sharing of the emission constraint among emitters. In conclusion, emission permit markets are regarded as decreasing the emissions at the lowest cost, creating a general price (overarching countries, and sectors) and guarantees that the emissions stay within a cap.

EU ETS

The European Union Emissions Trading System started in January 2005 and comprises around 13,000 installations in industry sectors and energy production. From 2013, the EU ETS encompasses half of the greenhouse gas emissions in the EU, not only including carbon dioxide but also N₂O and perfluorocarbons from several industrial sectors. The cap is set so that the carbon dioxide emissions of the included sectors will have decreased by 21%, year 2020, relative to the 2005 levels.

Initially, all emission permits were allocated for free with just a small share (0.13–3 per%) being auctioned, but starting from 2013 energy production installations will have to buy all their allocations through auctioning, while the industry sector will see a decrease in the share of their free allocations until 2020, when all their shares will be auctioned. Hence, the emission permits are estimated to be more frequently traded from 2013 onwards.

Between 2005 and 2012, the EU ETS has seen emissions decrease by 10%. Even though the carbon price is seen as a contributor to this, the major cause of the emission reductions so far is the economic crisis. Since the beginning of the crisis in 2008, the ETS market has experienced a surplus of allowances and international credits; by the end of 2011, the total number of allowances added up to 8.720 million tons of carbon dioxide while the verified emissions were only 7.765 millions tons of carbon dioxide – creating a surplus of 955 million allowances. Many has considered the surplus the main reason for the sharp decline in the share price, falling to below EUR 10 in mid-2011, causing a real risk of seriously disrupting the functioning of the carbon market, and undermining the incentives to promote investments in clean-tech. In order to decrease the surplus and stabilize the carbon price, the Commission has suggested a 'back-loading', or 'set aside', of the permits. This would mean a temporarily, or

permanent, removal of an amount of emissions from the market. The conditions for such market interference are, however, still discussed and highly uncertain.

The states' income from the auctioning of emission permits does not have to go to any specific purpose.

In the first phase of the European Union emission trading system (EU ETS), starting in 2005, carbon emission permits (known as European Union Allowances (EUA)) were traded at prices ranging from €30 to below 10 Euro cents. In the second phase, starting in 2008, prices fluctuated between €30 and €8. A range of derivatives has developed for trading on a growing market dominated by a few large players. Researchers have attempted to assess the main drivers of the price of an emission permit. Several studies have found that carbon credits are highly dependent on policy and regulatory interferences. Other factors that influence the price of permits include the price of natural gas, oil and coal, the variability of weather, fluctuations in the level of GDP and the occurrence of the global financial crisis.

In theory, the price of permits under a cap-and-trade should establish the marginal abatement cost sufficient to meet the cap set in the scheme. In reality, price volatility has been substantial. Research shows that price volatility was mainly caused by fuel prices, weather and policy developments. In addition, the EU ETS is a relatively new market that in general requires time to realise real price discovery. Other researchers argue that the market will never produce a right carbon price, since assets must be owned and they must be divisible with appropriate legal and institutional frameworks in place.

A futures market established for a flexible emission fee will also be based on artificial scarcity. The future price is likely to be influenced by fundamentals and it is reasonable to believe that futures prices will be as volatile as EUA.

3.3 Flexible emission fees

The flexible emission fee⁸ mechanism is based neither on volume nor on price explicitly, and in that respect it differs from both a tax or a cap-and-trade system. Instead, it relies on three pillars; a flexible fee, a futures market and a repayment mechanism.

The flexible emission fee mechanism is basically a continuously adjusted tax pricing targeted emissions. Initially, this fee is set and adjusted by policymakers or a panel of experts the same way the control interest rate is set by a board in a central bank. Changes in the flexible emission fee are made in response to various indicators, e.g. the rate of emissions reductions or the rate of green technological development, to keep the market on track towards achieving the long-term environmental objectives. Unlike tradable emission permits, the environmental objective is flexible rather than fixed and can be adjusted over time (see also section 3.3.1 on environmental targets).

Largely, the flexible emission fee mechanism works as a traditional environmental tax. Emitters facing a marginal abatement cost lower than the flexible emission fee will benefit by choosing to abate, whereas emitters facing a marginal abatement cost that is higher will benefit by choosing to pay the fee. However, the flexible emission fee mechanism also encompasses a third alternative; the possibility to hedge against emission fee fluctuations on a futures market.

As the costs of risk and uncertainty have been acknowledged for centuries, policy makers have faced the challenge of balancing policy effectiveness and policy transparency. Whereas an emission tax optimally would change with fluctuating marginal damage costs, policy makers also have to target stable long-run market conditions for market participants. The idea behind the flexible emission fee mechanism is quite the opposite. Instead of aiming for stability, the policy makers would increase the risk by stochastic changes of the emission fee. By increasing instability, a futures market would be established where emitters can insulate hedge against uncertainty. Thus, increasing risk and uncertainty would result in more stability on the market and not in less stability.

The prices on the futures market would reflect the emitters' expectations of the level of future emission fees, which would be affected by the

⁸ Presented by Anders Höglund, who initially suggested the idea, and the Swedish Sustainable Economy Foundation.

markets' assessment of future emission levels, green technological development, political risk, etc. The futures market could thereby work as a pollution abatement price discovery function, providing the fee-setters with important information on the emitters' expected future abatement costs, risk assessments, etc. An important vision aspect of the flexible emission fee concept suggests that this information can be reprocessed into the decision rule of the fee-setters. This hypothetical feedback mechanism would then assist the fee-setters in discovering the optimal fee level, adjusted to the true costs of emitters and society. Given sufficiently rational expectations and sufficient information for a functional market to emerge, the flexible emission fee mechanism would have the potential to result in an optimized trajectory of emissions given technological development, marginal damage and marginal abatement costs.

The third notion of the flexible emission fee mechanism involves a reimbursement mechanism, which may be designed as a budget neutral repayment of the fee revenues. With uniform refund shares for all individuals and budget-neutrality, the interference of an additional fee/tax in the economy is assumed to be politically and publicly accepted. The reform is, however, also believed to have redistributive effects since low-income households by assumption will, on average, be compensated by more than they spend on emission fees. These progressive income effects are assumed to give positive general equilibrium effects on the economy, under most conditions, by increasing aggregate demand and employment in a beneficial way.

Although the optimal level of the flexible emission fee is considered to be substantial, the fee is suggested to initially be set at a symbolical, low level, insufficient to curb the emissions, but sufficient to enable and encourage the establishment of a futures market. Once the futures market has been established and the policy reform has been generally accepted, the fee will be raised to the level seen as needed by the fee-setters. At the same time, polluters will expect the fee to rise from the initial level motivating the emergence of a futures market.

It is assumed that rapid fee adjustments can best be managed by a panel of experts. The expert group considers factors such as the following when setting the fee:

- Price information from the futures market, including trends in the cost of abatement.
- Expected environmental impact of the use of resources or the activities causing emissions.
- Trend in the environment/status on reaching the target.
- Prevailing fluctuations in the economy, weather, energy prices and other activity determinants.
- Trends in bottom lines of polluters.

Below, the elements of flexible emission fees are summarised and described.

Figure 4. Elements of the flexible emission fee mechanism

- 1) Politicians set environmental targets.
- 2) The expert group makes sure that target is met by managing the fee based on available information.
- 3) The fee is set and adjusted repeatedly to promote desired emission reductions at least abatement costs.
- 4) Due to fee variations a futures market will emerge giving the polluter the possibility to insulate against variations and providing information to the expert group on average abatement costs.
- 5) Repayment of fee revenue to the public in order to ensure acceptability of mechanism.

An additional point to make is that a flexible fee, that is easy to adjust, could in theory promote more opportunistic behaviour among politicians for short run electoral reasons, which could sacrifice environmental progress. But in practice the opposite could also be true.

Flexible emission fees can be regarded in relation to three types of environmental targets: fixed, flexible and unspecified target. Here, we define an environmental target as specified in time and quantity. For

example, a 60% reduction by 2025 as compared to today's level of emissions. Hence, the three types of targets are:

1. Fixed: y reduction by year x
2. Flexible; $y \pm a\%$ reduction by year $x \pm b\%$
3. Unspecified: y reduction by year?

The latter could also be phrased as an environmental objective indicating the desired direction of change, rather than a quantitative target at some point in time.

If flexible emission fees operate under a *fixed environmental target*, it will basically be a quantitative mechanism.⁹ The flexibility of the mechanism is hence limited to the path of reductions, because a given reduction has to be made at a given point in time. Whether this is of societal importance will rely on the emission in question (e.g., is time a major factor for environmental consequences?) and on the mechanism's time horizon (short-term or long-term).

If the *target is flexible*, there is no point in time when a given environmental target has to be met. However, there is an objective of reaching the target within a flexible time span. The path of emission reduction is therefore a function of a dynamic weighing of marginal abatement costs and marginal environmental benefits. Information of industry's response to regulation can be incorporated along the way for cost to be minimized while a steady reduction of emission reductions will occur. This interpretation shares similarities with a price-based mechanism.¹⁰

In situations with an *unspecified target*, the emissions will be driven down by a steady increase in the fee, but there is no goal indicating when a given reduction should be made. This situation is the topic of the box below.

⁹ I.e. having a quantitative target on a specified date like in the case of tradable emission permits.

¹⁰ An environmental tax is a price on pollution. The tax makes environmentally harmful activity more costly and emissions are therefore reduced. However, contrary to a quantitative mechanism there is no guarantee that a tax will lead to the desired reduction.

Flexible fee without a target

It has been argued that emission reductions occur gradually when the fee is set to equal average abatement cost.* The fee is thus determined by the development in abatement costs and, in turn, the rate of reduction is determined on the market itself. Without a specified environmental target, there is no exogenous factor that can accelerate the emission reduction beyond the market rate of abatement.

This can be exemplified by energy efficiency taxes on cars. The regulator knows the population of vehicles and the individual energy consumption expressed as kilometres per litre of petrol. Furthermore, the markets of new and used cars provide plentiful information on the cost of increasing efficiency (marginal abatement costs). These conditions imply that the regulator can set a fee on energy consumption and know in fair detail what rational agents will choose to do and how the shift in vehicle populations will occur under gradually increasing fees that reflects the development of average abatement costs. Nonetheless, as there is no specified target, the shift will not be controlled, but only cost minimizing from the perspective of car owners; for instance, a car owner will not be forced to buy a new car prematurely when considering abatement costs. The car owner will postpone buying a new car as long as it is better budget-wise to keep the old one.

Without a target, there is no weighing of abatement costs and benefits (avoided damage costs) in order to make the change in energy efficiency of cars follow a socially optimal path, but focus is instead on minimizing car owners' costs of reduction. Hence, the fee is on poor technology rather than environmentally damaging emissions.

* Höglund, A. (2012): "A new method to reduce the emissions of greenhouse gases", Appendix 3 in Enell, M. (2012): "Flexible Emission Fees – An incentive for driving sustainable production and consumption", TemaNord 2012:511, and Sanctuary & Höglund (2005): "A Flexible Pollution Tax – Preliminary Research Investigation", Cargine and Swedish Environmental Research Institute.

The fixed environmental target was introduced in the Swedish Sustainable Economy Foundation's briefing paper on phosphorous and nitrogen, which is presented in section 3.5. In other presentations of flexible emission fees, there is no specified environmental target.¹¹ The notion of a

¹¹ Höglund, A. (2012): "A new method to reduce the emissions of greenhouse gases", Appendix 3 in Enell, M. (2012): "Flexible Emission Fees – An incentive for driving sustainable production and consumption", TemaNord 2012:511, and Sanctuary & Höglund (2005): "A Flexible Pollution Tax – Preliminary Research Investigation", Cargine and Swedish Environmental Research Institute.

flexible goal is introduced in this project through discussions with the Swedish Sustainable Economy Foundation and it forms the basic idea underlying the description of flexible emission fees in section 3.3 above.

3.3.1 *Futures markets*

The uncertainty generated by the flexibility of the fees would – it is argued – stimulate the development of futures markets. This would be so, as a futures market might represent a way to hedge against the risk created by a flexible fee. At the same time, a futures market may represent a way of achieving price or cost revelation.¹²

3.3.2 *Functioning of futures markets for flexible emission fees*

Regarding the development and functioning of the futures market in flexible emission fees, the originators of the flexible fees mechanism reason as follows:¹³

If the (initial) fee for emission of a certain substance is set significantly above the cost of emissions reduction, there will be a clear incentive for reducing emissions substantially. However, the resulting environmental improvements might be achieved by an economic loss to society that very well could be above the environmental gain to society, if e.g. capital destruction¹⁴ is assessed to be necessary/worthwhile as an element of the effort to reduce emissions.

¹² A traditional futures contract is an agreement to buy or sell a specific quantity of some asset at some time in the future at a price agreed upon at the time the agreement is made.

Any asset whose future price is uncertain could be a candidate for a futures contract. There must be enough consumers and producers who want to diminish the price uncertainty (hedgers) and enough other traders willing to take on that risk (speculators) in order for the contract to be successful, i.e., worthwhile for the contract to be listed on a futures exchange.

Actual delivery of the underlying asset of a traditional futures contract is not usually expected – contracts are “offset” or cleared. However, if necessary, contracts are ultimately legally enforceable.

Each contract has different specifications because the underlying assets are different. The contract specifies the asset, the amount of the asset, and the date of expiration. The advantage to having exchanges is that the contracts are standardized and therefore much more attractive to both hedgers and speculators. In futures trading the two parties doing the trading are actually making the contract with the exchange’s clearinghouse, which guarantees performance of both sides of the transaction. So a trader wishing to offset a contract does not have to find the other party to the original transaction; the clearinghouse will substitute any other party.

¹³ This section is to a large extent following the reasoning in the paper “A new method to reduce the emissions of greenhouse gases” by Anders Höglund.

¹⁴ For example premature shutdown and scrapping of otherwise well functioning equipment.

Figure 5. Functioning of futures market

Imagine two polluters both facing individual marginal abatement costs as represented by the marginal abatement costs (MAC) curve above. Polluter A produces at a level causing emissions at level Q_A and with marginal abatement costs equalling c_A , while polluter B produces at a level causing emissions at level Q_B and with marginal abatement costs equalling c_B . If a pollution tax/fee is introduced t , where $c_B \gg t \gg c_A$ then polluter A will have a clear incentive to reduce emissions to a level equalling Q (rather than pay the fee for the quantum of emissions $Q_A - Q$), and thus only pay the fee for the remaining quantum of emissions Q . Further, once polluter A decides to abate and to invest to bring emissions down to level Q , polluter A will like to hedge against future increases in the pollution tax/fee that would alter the optimal investment decision (to abate to a level below Q). On the other side, polluter B will have no incentive to reduce emissions, with a pollution fee at level t .

However, continuing excessive emissions could conversely also lead to substantial costs to society. This could be the result, if the fee for emitting the substance is set significantly below the cost of emissions reduction, leaving no incentive for reducing emissions.

Thus, the level of an emissions fee that minimizes polluters' abatement costs is expected to be correlated to the average cost of reducing emissions – that, however, will in general be unknown (at least to the regulator).

Therefore, a so-called “flexible emissions fee futures market” is introduced as a price and cost insurance market that elicits price and cost revealing behaviour of the polluters as well as expectations of other actors. The “flexible emissions fee futures market” provides information to the

regulator about the polluters' cost of reducing emissions as well as different actors' expectations to future costs of reducing emissions. In turn, information about the "current" cost minimizing level of the emission fee is disclosed by means of the "flexible emissions fee futures market." In this market, the "emissions fee futures contract" is a binding agreement between buyer and seller about the "delivery" of the emissions fee, for the stated amount, for the stated substance, for the stated time period, to a determined price (the price of the futures contract at the time of agreement), including a clearing procedure at the date of expiry.¹⁵

When introducing such an emissions fee futures market, "polluters" facing reduction/abatement costs below the current future emissions fee, "set" by the price of the emissions fee futures contract on the market, will in principle find it worthwhile to abate and to sell emissions fee futures contracts¹⁶ to reduce their risk, while polluters facing reduction/abatement costs above the current future emissions fee will in principle find it worthwhile to pay the fee and to buy such contracts to reduce risk.

Speculators can also engage in the market, whose activities can reduce fundamental errors in the pricing of the contracts. However, speculators might also increase errors in the pricing of contracts, as speculators might have different agendas.

Contracts can cover one or – more likely – more emission fee periods. On the expiry date, the contracts are then cleared between sellers and

¹⁵ Thus, it is presupposed that trade in emission futures contracts on an emission fee futures market can be established according to the same principles as trade in traditional commodity futures contracts on a traditional commodities futures market, that is claimed to have proven to be able to provide good liquidity and low transaction costs, applying the same rules and regulations as are established on a traditional commodities futures market. In continuation hereof, an emissions fee futures contract is defined by the following terms:

– The emissions fee futures contract is a binding agreement between buyer and seller about the delivery of the emissions fee, a) for the stated amount, b) for the stated substance, c) for the stated time period, d) to a determined price – that is set as the price of the futures contract at the time of agreement.

– By delivery is meant a clearing procedure on the day when the contract expires – thus on the expiry date the contract is cleared between seller and buyer based on the difference between the contracted price and the expiry price, i.e. the price/fee set at expiry date.

¹⁶ The seller of the contract is facing costs below the current fee and will find it worthwhile to abate as long as the marginal abatement cost is below or equals the current emission fee, but would also like to insure against increasing fees that would alter the optimal investment decision, and would therefore like to fix the future cost (at least for the investment period), by selling a contract that in principle on expiry date entitles the buyer to a payment, *at the agreed price on contracting date*, of the emission fee for the specified substance, in the specified amount (that is not abated), during the specified time period. Thus at expiry date the buyer in principle receives a payment equalling the agreed price on contracting date, and then pays the actual fee for the period following after expiry date – in practice payments are cleared based on the difference between the contracted price and the expiry price.

buyers, based on the difference between the contracted price and the expiry price, i.e. the price/flexible emissions fee set at expiry date.¹⁷

During each emission fee period, all “polluters” pay the emission fee determined by the market, on the expiry date the payment is made to the regulator.

The emissions fee futures market should thus serve to facilitate/provide a sufficient number of contracts for a certain period, to enable a polluter to fix the cost at the current cost/price for the futures contract for emissions during the same period whenever the polluter wants to do so!

Fulfilling this, the trade in emissions fee futures contracts on the futures market, will – due to the differences in costs and risks between polluters – contribute to moving the price of the emissions fee futures contracts towards the overall average cost of emissions reduction, and thus (in the long term) contribute to moving the emissions fee towards the same level.¹⁸

The possibility for polluters – and other actors – to fix the cost at the current cost/price for the emissions fee futures contract, and thereby to insure against changes in the emissions fee, facilitates the opportunity to develop and invest in e.g. (new) abatement technologies as it enhances the predictability of investment decisions and thereby promotes development at a rate that minimizes abatement costs. Price on futures market.

The price on the futures market is expected to reflect expectations to the future fee. In turn, however, the futures market expectations are influenced by a number of factors and will entail a dynamic feedback as the expert group incorporates information from the futures market when setting the fee (see illustration below).

The many factors influencing expectations will also influence the polluter’s abatement costs; or say, for a polluter to make a decision to install a cleaning device attention must be given not only to the fee level, installation and operating costs, but also factors such as sales prospects, input prices etc.

¹⁷ The trade on the futures market will therefore generate a gain or a loss exactly covering the difference in the emission fee cost.

¹⁸ This cost-revealing feature is considered central to the idea behind the introduction of the flexible emissions fee futures market.

Figure 6. Factors influencing price on futures market

If no environmental target is set (or only a loosely formulated target along the lines of a gradually declining level of emissions), the market will not consider the “environmental trend”, but rather the “technological trend” – or, say, the expectations for the development of abatement costs.

3.3.3 Emergence of futures market

Fluctuations in the flexible emission fee are the basic condition for the emergence of a futures market.

It is unclear what market characteristics and what level of fluctuation are needed for the agents to opt for futures. One fundamental aspect is the polluters’ ability to pass on the fee to consumers. If the polluter is a price taker of international market prices, he cannot pass on fees to consumers. If the polluter is a price-setter and able to pass on fees, it is less likely that a futures market will emerge.

Acting on a speculative futures market requires a high level of resources and insight. However, as the polluter can trade via middlemen, the speculative part can be left for those willing to engage. In spite of this, an extensive number of agents is necessary for a well functioning market to emerge.

3.4 Repayment mechanism

Repayment of revenues from flexible emission fee or auctioning of tradable permits can be spent in various ways. The options include (i) fiscal recycling to non-climate related programs, (ii) recycling to emission reduction expenditure or incentive programs, (iii) recycling to reduce inefficiencies in the tax system, (iv) recycling to reduce distributional effects, and (v) recycling to reduce competitiveness impacts. Also, the latter two options could be an important factor for consumers and/or polluters to accept new taxation.

Repayment can to a large extent be discussed independent of its source. Money can be spent in a beneficial way, irrespective of whether it is generated via a fee or permit auctioning. This is the reason why the subsequent analysis focuses on the mechanism narrowly, and not on the repayment mechanism. Still, an overview of the repayment mechanism is given below as it is an element of major relevance both in general and in relation to flexible emission fees.

3.4.1 *Background*

All emission abatement policies are likely to add to the distortions in the economy created by the tax system. Traditionally, economists have argued that the costs of reducing emissions are significantly lower under economic, incentive-based, policy instruments, such as emission taxes and tradable emissions permits, than under administrative methods, such as technological standards or direct regulations. However, there is also research emphasizing the difference between policy instruments for controlling emissions that raise revenues for the government and those that do not. Revenue-raising instruments include emission taxes and tradable emission permits that are sold or auctioned to firms. Non-revenue-raising instruments include tradable carbon permits that are distributed free of charge.

There are different ways the revenues can be recycled to the economy that benefit the society. The revenues can be recycled to households, to firms or to the government. On the household level, the revenues raised can be used to reduce marginal tax rates that discourage work effort and investment. Revenues can also be repaid in a lump-sum transfer with the purpose of increasing aggregate demand in general. On the firm level, revenues can be reimbursed directly to the emitters to compensate for increasing costs and lost competitiveness or indirectly by cutting distorting taxes. If revenues are spent on governmental level, the

revenues could be used to reduce the federal budget deficit, which would mean fewer distortions on employment, investment and consumer spending in the future. Revenues could also be used to finance additional public spending or long-run investment in public goods or in research and development, which only in the latter case would give an efficiency gain to society.

Regulations that increase production costs also tend to reduce the level of employment and investment in the economy. The costs of these spillover effects in the labour and capital markets are called the *tax interaction effect*. On the other hand, the revenue-raising instruments can give potential economic gains if the revenues are used to reduce other distortions in the economy. This *revenue-recycling effect* can offset some of the costs of the tax interaction effect.¹⁹ Research suggests that with second-best environmental taxation, i.e. a setting with pre-existing distortionary taxes, the presence or absence of revenue-recycling effects are important to the choice of environmental policy instrument.

Among economists, there has been a debate whether revenue-neutral substitution of environmental taxes for other distortionary taxes such as personal income tax, might offer a double dividend, i.e. improve the environment as well as reduce the welfare costs of a distortionary tax system. For policymakers the no-cost idea of a green tax swap is especially appealing, as the values of environmental benefits are uncertain. A consensus has, however, emerged in the literature arguing that the revenue-recycling effect cannot offset the tax interaction effect since environmental taxes typically aggravate labour market distortions even if revenues are employed to cut pre-existing distortionary taxes.

The presence of the tax-interaction effect makes indeed the revenue-recycling effect more fundamental to overall efficiency gains. Research shows that in the presence of distortionary taxes, environmental instruments that fail to exploit the revenue-recycling effect, as in the case where revenues are returned to the economy through lump-sum tax cuts rather than through cuts in marginal tax rates, cannot improve economic efficiency.^{20, 21} To summarize, using tax revenue for any of these uses – funding distortive marginal tax cuts, reduction of government deficit, or

¹⁹ Parry, I.W.H., 2001, "Revenue Recycling and the Cost of Reducing Carbon Emissions" in Climate change: economics and policy: an RFF anthology, edited by Michael Toman, Resources for the Future, Washington.

²⁰ Goulder, L.H., I.W.H. Parry and D. Burtraw, 1997, "Revenue-raising versus other approaches to environmental protection: The critical significance of pre-existing tax distortions", RAND Journal of Economics, 28(4), 708–731.

²¹ Bovenberg and De Mooij, 1994, Environmental Levies, AER 94(49), 1085–1089.

productive government investing – could promote growth. However, if revenue is not recycled in an efficient way, the costs of a carbon tax would be substantially higher

Equity aspects often dominate the tax-reform discussions. Many studies indicate that environmental taxes are regressive and disproportionately affect low-income groups.²² Equally distributed tax revenues would more than compensate these groups for any regressive effects experienced from the tax itself. If the equity dimension is included in the analysis of alternative recycling options, the results might change also in efficiency terms. If society holds income-inequality aversive preferences, i.e. when people think income inequality is unfair, theoretical analysis shows that equity effects can dominate the efficiency effects of recycling under certain labour market regimes. Then increasing lump-sum welfare payments can be more appropriate than reducing distortionary taxes mainly borne by the rich, even if the latter strategy involves clear efficiency gains.²³ This result depends on the assumed income distribution, distribution of carbon production and distribution of carbon consumption and is ultimately an empirical question.

Efficiency and equity arguments notwithstanding, revenue recycling also gives political benefits. Budget-neutral and distribution-neutral environmental reform schemes are key to political support and public acceptability. In particular, distributive effects are often a large part of the difficulty of reaching national or multilateral agreements on environment. Economics wisdom says that the policymakers should use policy instruments to get the price of emission right to induce efficient behaviour and then use the income tax or transfer schemes directly to produce the aimed distribution. If an environmental tax or permit scheme raises the price of energy, which is consumed disproportionately by the low-income households, lower taxes or higher transfer programmes could balance the difference. If environmental gains are disproportionately concentrated to the high-income households, income taxes might be raised to offset the redistribution effects.

Certain emitters, such as energy-intensive industry or the automotive industry, could be more intensely affected by an environmental tax. To

²² For a summary, see Melfcalf, G.E., S. Rausch and J. Reilly, 2011, "Distributional impacts of carbon pricing: A general equilibrium approach with micro data for households", downloaded from <http://www.voxeu.org/index.php?q=node/6629#> on 2011-06-16 12:05.

²³ Proost and Van Regemorter, 1995, The Double Dividend and the Role of Inequality Aversion and Macroeconomic Regimes, *Int. Tax and Public Finance* 2, 207–219.

avoid massive lobbying efforts for support to avoid the impact of environmental taxes, reimbursements of revenues such as free emission permits to these special-interest groups could be necessary.

In the analysis above, efficiency, equity and political arguments could be rationalised as expressions of economic self-interest. Rational individuals, firms and governments are assumed to have well-defined preferences, profit or welfare functions that they seek to maximize under full information on the economic consequences of various policies. Economists are generally aware that such assumption only provides a benchmark, which may be more or less suitable as an approximation of reality. The approximation is less appropriate the more complex the policy issues are and the more they are influenced by sentiments. Environmental policy would seem to qualify as such an area where it may be difficult to understand how attitudes are formed and actions are taken with the help of traditional economic theory only. Instead, there could be a lot to gain from drawing on psychological research and behavioural economics.

Recent studies show that consumers' economic decisions are strongly affected by perception. Research shows that a larger, direct visibility of a tax gives stronger behaviour-inducing effects.²⁴ Timing also plays an important role in regulatory efficacy. Research shows that economic benefits that are immediate, such as sales tax incentives, have a much greater behavioural effect than benefits that are delayed, such as income tax incentives, despite equal economic value.²⁵ Thus, these kind of psychological effects could also be of importance for the decision on how to spend collected revenue wisely.

To summarize, evidence from the economic literature shows that the most efficient and growth-promoting way of spending revenue would be to remove other, distortive, taxes in the economy. It could also be efficient to invest in research and development, if the market tends to underinvest in these activities due to market imperfections. In addition, psychological research shows that the economic behaviour under some circumstances could be described as irrational. Equivalent economic policy options could be judged differently due to different perception biases. This implies that other factors than theoretic efficiency, such as

²⁴ Getty, R., A. Looney and K. Kroft, 2009, "Salience and Taxation: Theory and Evidence", *American Economic Review*, 99(4), 1145–1177.

²⁵ See for example Gallagher, K.S. and E. Muehlegger, 2008, "Giving Green to Get Green: Incentives and Consumer Adoption of Hybrid Vehicle Technology", KSG Working Paper No. RWP08–009 or Jaffe A.B, R.G. Newell and R.N. Stavins, 2000, "Technological Change and the Environment", NBER Working Paper 7970.

policy visibility, should be considered when designing optimal policy. Lastly, to increase political support and public acceptability, it could also be relevant and necessary to encompass distributive effects in the policy decision, to counteract regressive income and competitiveness effects that are considered unfair by voters and firms.

3.4.2 Flexible emission fees and tradable emission permits

According to the initiators, the concept of flexible emission fees encompasses revenue recycling by means of a uniform lump-sum transfer to all households in a nation. As already argued this trait is not unique to this mechanism but it can be applied to all revenue-raising instruments. It can, however, be valuable to relate the notion of the benefits of lump-sum transfers to relevant research in the area, as summarized above.

Without support of the public, the introduction of emission fees would be difficult. Therefore, lump-sum transfers of emission fee revenue equal per capita are believed to increase public acceptability. Furthermore, the redistribution of economic resources, in particular to low-income households, is believed to increase aggregate demand and through the multiplier effect result in increasing output and employment.

In general, distributing funds lump sum has a higher efficiency cost than using funds to reduce distorting marginal tax rates. Whether the low-income households are net gainers or net losers from this kind of scheme, with emission fees and lump-sum transfers, is an empirical question, depending on the income distribution as well as on the distribution of emission production and consumption. Although there are studies showing that lump-sum transfers of fee revenues in some cases for equity reasons might be the preferred recycling option, it does not seem reasonable to believe that lump-sum transfers also give positive macroeconomic effects. Since environmental taxes, as all other taxes, distort the choice between work and leisure and between consumption and savings, the initial deficiencies in distribution must be substantial for lump-sum transfers to offset these costs. To conclude, a lump-sum transfer of emission fee revenues could be the best policy option with regard to political support and public acceptability, however it is unlikely that lump-sum transfers are more efficient than a marginal income tax reduction.

Ideally, a more thorough analysis of the welfare effects using a formal model would be warranted. This is, however, outside the scope of this evaluation.

Example of repayment mechanisms

In the Nordic countries, Denmark introduced carbon taxes in 1993, Finland in 1990, Norway in 1991 and Sweden in 1991. Three of these countries, Finland, Norway and Sweden allocate the revenues from their carbon taxes to the general government budget. Hence, there is no specific offsetting of other taxes against the carbon taxes. In Denmark, the carbon tax revenues from industry are recycled back to industry through reduced social security contributions and through investment incentives. In addition, in 2009, a per capita deduction was introduced in Denmark to counteract the effects of increases in energy taxes. Due to its lump sum nature, “the green check” has equity effects in the sense that households with high energy consumptions tend to have high income and will thus pay relatively more in energy taxes compared to low-income, low-consuming households. All tax payers receive a deduction of DKK 1,300 plus DKK 300 per child. However, taxpayers with incomes above a given threshold receive no “green check” at all.

Another example of revenue recycling is in the Netherlands, where the revenues are recycled back to households and industry through personal and corporate tax relief.

3.5 Description of analytic cases

This section describes literature cases where flexible emission fees and tradable emission permits, respectively, have been applied to nitrogen and phosphorous emissions.

The cases were both developed for a Swedish context, but are very different in nature, which makes direct comparison difficult. However, the introduction of the two analytical cases is a useful way to bringing forward the differences and similarities between the proposed applications of the mechanisms.

3.5.1 Permit fee system for nitrogen and phosphorus

In attempt to decrease eutrophication of the Baltic Sea, the Kattegat and the Skagerrak, the Swedish Environmental Protection Agency has proposed a fee-system aiming at decreasing emissions of nitrogen and phosphorus in a cost-efficient manner. The system overarches a set of different sectors and regulates their activities by setting obligatory emission caps. If an organization’s emissions exceed its cap, the organization has the choice either of decreasing its emissions or of paying a fee.

The fee income is then used by the regulatory authority to pay for compensatory measures – reducing phosphorus or nitrogen elsewhere – in organizations excluded from the fee system (p.7). Instead of letting the market supply and demand set the price of emissions, the fee will be set with regard to the costs of acquisition of compensatory measures. The fee is aimed to finance compensatory measures, rather than to guide the participants' behaviour (Naturvårdsverket, p. 102). Whether or not the point sources will be allowed to trade with emissions permits, as in a “cap and trade”, is not yet decided, but will be further investigated (p. 102).

Initially, the distribution of the individual caps will be guided by what is technically achievable. Initially, the Swedish Environmental Protection Agency proposes the fee system to assign emission caps to point sources, such as wastewater treating plants as well as pulp and paper industries, but to later on to incorporate diffuse sources such as agriculture, iron and steel industries as well as chemical industries, as these are also major nitrogen and phosphorus polluters. The nitrogen and phosphorus fee is still only a proposal by the Swedish Environmental Protection Agency.

3.5.2 Flexible import tariff and fee scheme for nitrogen and phosphorus

Phosphorus is an indispensable nutrient, finite and scarce, but also recyclable. Threats of peak-phosphorus notwithstanding, the current over- and misuse of phosphorus cause serious over-fertilization of water.

Since phosphorus mainly enters the national supply chain through imports of fertilizers and food, the flexible emission fee proposal²⁶ for controlling phosphorus mismanagement involves a flexible import tariff on phosphorus-containing commodities. By increasing the price on phosphorus, the intention is to stimulate a market for phosphorus recycling. If this up-stream measure is insufficient, the next policy step involves an end-user fee. Phosphorus leaks into waterways mainly from water treatment plants and agriculture, and by levying a fee on phosphorus emission, a market for phosphorus-rich products like urine could be promoted.

Nitrogen is another indispensable nutrient causing over-fertilization of water, although abundant and non-recyclable. The main sources of

²⁶ Hinton, S (2013): Briefing Paper – Flexible emission fees applied to phosphorous (P) and nitrogen (N).

nitrogen pollution are industry, combustion engines and agriculture. The flexible emission fee proposal for nitrogen diffusion encompasses a flexible fee on combustion engines, industrial processes and artificial fertilizer production. As for phosphorus, the proposal also suggests an adjustable tariff on food imports.

The proposed phase-out time for phosphorus imports is assessed to 20 years, whereas the zero emissions target for nitrogen is assessed to be achieved in 30 years. The proposal suggests that the import tariffs would be adjusted if the level of imports was not falling in sufficient pace.

To compensate households for increasing food prices, the flexible emission fee proposal advocates a fee revenue redistribution, as suggested by means of a general reduction of personal taxes. Revenue income is also suggested to be directed towards investments in infrastructure for phosphorus recycling.

This proposed policy scheme is believed to restrict imports of phosphorus and nitrogen and stimulate a market for phosphorus recycling.

4. Analysis

Based on the four categories of criteria and the description of flexible emission fees and tradable emission permits presented above, this chapter evaluates the two mechanisms on the general (theoretical) level and when applied to analytical cases.

4.1 Evaluation on the general level

The general comparison of flexible emission fees (FEF) and tradable emission permits (TEP) revolve around the four topics:

- Efficiency
- Acceptability
- Uncertainty
- Transaction costs.

Each topic is subdivided and evaluated in the comparison of the two mechanisms. The table below highlights the differences identified in the analysis. Each element is elaborated subsequently.

Table 3. Evaluation of flexible emission fees (FEF) as compared to tradable emission permits (TEP) on the general level

Topic	Characteristics of FEF
Efficiency	<p>If no pre-set environmental target, risk of very slow emission reduction, but also opportunity to steepen reduction path given new information. However, also prone to continuous lobbying</p> <p>FEF allows the polluters to minimize costs of reducing emission parallel to TEP</p> <p>FEF does not ensure socially optimal emission reductions, but a cost minimizing approach</p> <p>Market information that can be used to adjust fee and reduce abatement costs is provided via futures markets, but at the cost of increasing market variability and risk</p> <p>An expert group with operational freedom makes continues fee adjustments, based on available information. This is believed to improved decision making, but is not clear how the expert group weighs conflicting elements.</p>
Acceptability	<p>FEF revenue is proposed to be redistributed to consumers benefiting public support to the mechanism. This could be done for TEP as well.</p> <p>An expert group without full democratic control could prove difficult to accept.</p>
Uncertainty	<p>Fee fluctuations are a source of uncertainty which, however, is thought to be mitigated by a futures market. Uncertainty and fluctuations are nonetheless also inherent to TEP.</p>
Transaction cost	<p>Futures markets involve cost. It is not clear to what extent transaction costs will increase, but it is to be expected that the related costs will be relatively smaller in an extensive market with many polluters.</p>

It has been argued that flexible emission fees “does not exist to put a price on the environmental damage caused by pollutant...it is...meant to put a price on the pollutant emissions so that the underlying causes to the damage can be eliminated.”²⁷ This statement reveals a fundamentally different approach than mainstream environmental economics, where the objective is typically not to eradicate an emission but to reach a socially optimal level of emissions (that can be zero). In this approach it is necessary to conduct a valuation of damages and not just to phase out costs at least cost.

²⁷ Höglund, A. (2012, p. 18): “A new method to reduce the emissions of greenhouse gases”, Appendix 3 in Enell, M. (2012): “Flexible Emission Fees – An incentive for driving sustainable production and consumption”, TemaNord 2012:511.

Environmental effectiveness

Flexible emission fees are identical in providing emission reduction in cases where both have parallel long term environmental targets and time frame. This is opposed to a traditional tax in which there is a fixed price but an uncertain quantitative endpoint.

However, the endpoint as well as the path of emission reduction may differ between flexible emission fees and trade emission permits mechanisms. That is e.g. in cases where flexible emission fees have no fixed target (cf. section 3.3.1), as compared to tradable emission permits that always will operate with fixed targets.²⁸

Both the path and speed of emission reductions and the endpoint can be of importance in situation where damage costs accumulate over time or in cases with irreversible consequences of continued emissions. From an environmental point of view the temporary aspect of emissions are often central, which implies that the specific type of pollution and design of flexible fees is important in this respect.

Tradable emission permits ensures that the target is met, whereas flexible emission fees can loosen or strengthen targets along the way. This has the consequence that tradable emission permits offer greater certainty of reaching a pre-set target, which is relevant in cases where you have – politically – fixed targets to which the regulation has to ensure compliance. In other cases, the flexible fees system may correspond well to indicative, reduction targets (e.g. “good ecological status”, “reducing waste generation”).

It remains unclear precisely on what basis the expert group will continuously set the flexible emission fees; one element in their decision rule appears to be the degree of fulfilment of environmental goals. Also the fact that there are often major lags between a change in behaviour and the impact to be detected in the environment will make the changing of targets and the setting of taxes very complex. However, the setting of the flexible emission fee can also be taken to be affected by speculation, level of investment in abatement technology but possibly also elements of public, stakeholder and political pressure. The creation of environmental policies and the setting of environmental targets is a political process, but the continuous fee setting may introduce an additional risk of eroding the environmental ambitions along the way.

²⁸ The targets under tradable emission permits will be gradually reduced from one trading period to the next.

Economic efficiency

Both instruments allow the polluter to act in a cost minimising way to the benefit of both mechanisms' economic efficiency.

Flexible emission fees have been presented in a rightful context, where the difficulties of assessing costs and benefits of environmental policy leads to inefficient decision making of regulators and in turn polluters and consumers.²⁹ Planning for optimality is impossible, which is the reason why markets are left to allocate. However, in mainstream environmental economics the regulator puts up a framework to correct for externalities under which the market can operate. This framework is established based on available information of both costs and benefits. The cost revealing aspect of futures markets is seen as a way to overcome these informational problems and guide emission reduction. However, two questions arise:

- If abatement costs are not compared to environmental benefits of abating, it is not possible to determine whether a change is socially desirable.
- Is the information revealed on futures markets an smart approach to improve regulation; basically you choose to introduce risk, which is typically regarded as a bad thing, in order to reach a new level of stability (and information).

The search for optimality is a basic economic approach to policy making. However, when a target is politically agreed, economics turn to finding the most cost effective way of reaching it. Managing the flexible emission fee without a specified target – quantitative and in time – is thus neither an efficient nor cost-effective approach. Without a specified targets the approach is to minimize abatement costs disregarding environmental damage. In practical terms, this is some times the way politics work: let's solve this problem and phase out the substance slowly. Most often politicians set specified goals that range from bans to quantitative targets both of which are fixed in time.

When making the choice of introducing risk to a market, the regulator must be confident that the benefits of doing so outweigh the costs. The information gains and possibility of hedging on a futures market –

²⁹ E.g. Höglund, A. (2012): "A new method to reduce the emissions of greenhouse gases", Appendix 3 in Enell, M. (2012): "Flexible Emission Fees – An incentive for driving sustainable production and consumption", TemaNord 2012:511.

that on exist as a consequence of volatility – are benefits that can reduce abatement costs. On the other hand, risk is not free. The introduction of volatility implies a risk premium on top of a comparable risk-free choice of abatement. And speculators will need return on their investments. These pros and cons of the flexible emission fees are not possible to assess and less so quantify within this analysis. It is nonetheless key in determining the attractiveness of flexible emissions fees as a mechanism to reduce emissions.³⁰

Irrespective of these aspects, flexible emission fees and tradable emissions permits are in principle parallel if they have the same environmental target and intervals between adjusting fee/number of permits. Other examples of mechanisms that have been discussed that have the abilities to reveal a price on a market or stimulate stability include a flexible cap and trade and Pigouvian taxes. Most of these mechanisms are new combinations of old instruments.

³⁰ A future question for investigation is to determine the nature of information that is produced on a flexible emission fee futures market. And how much more useful is this information for the purpose of regulation compared to e.g. the information that lies in the change in emissions as response to a regular tax?

A comment on macroprudential policy in the finance sector

When analysing the flexible emission fee mechanism, it could be useful to get some insights into parallel problems and analyses in other economic areas and literatures.

In the aftermath of the financial crisis, a substantial number of macroprudential reforms have been suggested. Economists and policymakers are focusing on systemic risks in the financial system and various instruments to address them. One example includes the risk of banks issuing too much short-term debt (excessive money creation) in a socially non-optimal way, leaving the system excessively vulnerable to costly financial crises. Hence, the banks do not internalize its social costs, which is the definition of a fundamental market failure. Among the variety of ways for a regulator to address this externality, two, for environmental economists, classical instruments are suggested.

Stein (2012) suggests a flexible “cap-and-trade” system in which banks are granted tradable permits, each of which allows them to do some amount of money creation. The author claims that the market price of the permits reveals information about banks’ investment opportunities to the regulator, which can then adjust the cap accordingly. When the price of the permits goes up, this suggests that banks in the aggregate have strong investment opportunities, so the regulator should loosen the cap by putting more permits into the system. Another proposal by Kashyap and Stein (2012) and others suggests that with a reserve requirement on the banks’ short-term liabilities, changes in the quantity of reserves can be used to implement a socially efficient, time-varying regime of Pigouvian taxes.

Both cited articles emphasise that optimal Pigouvian taxes are likely to be time-varying, and to depend on information that is not available to the regulator. In order to obtain this information, the authors state that it helps to have a market price, as in a cap-and-trade system.

Sources: Kashyap, A.K. and J.C. Stein, 2012, “The Optimal Conduct of Monetary Policy with Interest on Reserve”, *American Economic Journal: Macroeconomics*, 4(1), 266–282.

Stein, J. 2012, “Monetary Policy as Financial Stability Regulation”, *The Quarterly Journal of Economics*, 126(1), 57–95.

Dynamic efficiency

Both mechanisms increase costs of pollution and give incentives to abate emissions and introduce new technology. However, stability could lead to a higher level of investment in abatement reducing cost via innovation. This is one of the things that flexible emission fee with a futures market aims at by giving an opportunity for polluters to insulate against fluctuations giving security in the life span of investments.

The EU ETS market for carbon emission permits has suffered from high fluctuations which proposedly has let to inoptimal decisions of both over and under investments in abatement. Also, it has been argued that technological diffusion is stronger with a tax than with a permit system, regardless if it is auctioned or handed out for free. Popp *et al.* say “Under tradable permits, technology diffusion lowers the equilibrium permit price, thereby reducing the incentive for participating firms to adopt. Thus, a permit system provides a lower adoption incentive than a tax, assuming the two instruments are equivalent before diffusion occurs”.³¹

It has been argued that flexible emission fees reduces capital destruction as the fee will reflect marginal abatement costs via the futures market allowing polluters to phase out pollutants or yesterday’s technology at their preferred speed. This contributes to minimizing abatement costs. However, the fee and therefore the incentive to adopt new technology can be lowered due to a lower fee to the extent that environmental damages are disregarded in the setting of the fee.

Efficiency of redistribution of revenue

Given that both mechanisms generate revenue from fee or permits auctioning, the same possibilities for efficiency improvements in redistribution exist. The spending of revenue cannot be seen disregarding the way they have been collected. However, when the revenue is generated the mechanisms in question can thus be regarded as parallel to the extent that revenues can be generated to the same degree and spent on e.g. development of emission technologies or reducing distortive taxes.

Regarding the efficiency of revenue recycling, economic theory shows that emission tax revenue optimally should be used to decrease existing distorting taxes. Emission taxes should be levied to correct for an externality and not for revenue collection purposes, even if revenue would pay for additional emission reduction. Furthermore, the tax base will be decreasing and the governmental investments in additional emission reduction must be financed by other means.

Following the criteria definition above (section 2.3), the revenue repayment will increase the efficiency of the mechanism if it is redistributed to, e.g., research that will reduce abatement costs in cases where underinvestment in abatement technologies exists due to market failure. This is not the result if revenue is repaid to the public or other purposes.

³¹ Popp, Newell and Jaffe, 2009, “Energy, the Environment, and Technological Change”, NBER Working Paper 14832.

However, there can be many other reasons than efficiency for choice of repayment mechanism.

Tradable emission permits can be allocated with no cost to polluters (grandfathering) and thus without generation of revenue that can be redistributed. However, auctioning of permits allows redistribution of revenues parallel to the flexible emission fee. The case for many Nordic environmental taxes is, however, that they are regarded as a source of government revenue in line with income taxes. Financing government budget is a part of any taxation be it environmental, income or company taxes, which should be considered when designing mechanisms that are politically feasible.

Predictability

It is argued that the flexible emission fee with a well-functioning futures market will bring about a way to ensure predictability of costs and thus investment decisions. However, if the futures market is very volatile it could have the unwanted side effect that futures market option for polluters to insulate against fee fluctuation comes at elevated costs due risk levels.

The first period of time after introducing the flexible emission fee it will be difficult for the agents to create realistic and reliable expectation to the level of the fee. This lowers predictability, but is analogue in a tradable permit system.

It is noteworthy that the possibility to hedge against fluctuation is also a likely consequence of fluctuating markets – also a market for tradable emission permits. However, one of the advantages of a regular tax is that is constant and therefore only prone to more or less frequent changes by regulator (policy or political risk). Since predictability can be an asset of multiple mechanisms to varying degree, the question is as much what losses are provoked to attain it. These aspects cannot be clarified within this analysis.

Acceptability

Redistribution of revenues has been presented as essential in promoting acceptance. Yet, as both mechanisms have the same opportunities for revenue generation, they also have the same options for redistribution and in turn acceptability via spending of revenues.

One central point, in flexible emission fees is the pivotal expert group that could be difficult to accept. For the flexible emission fees to work and new decisions on fee levels taken continuously, a devoted expert group make swift decision making more likely than when relying on Parliament negotiation. Technocracy with no or little democratic control has appeal as a way to ensure decisions based on knowledge and long

term perspective. Parallels of the functioning of an expert group to that of a central bank are drawn in the appendix.

For expert groups to become broadly acceptable many changes have to occur in the way we regulate our economy and make decisions generally speaking. An independent expert group with operational freedom is far from today's situation and many decisions have to be made before a body is likely.

In the UK, legislation has been adopted that set targets for reductions of climate change emissions and the establishment of a Committee on Climate Change.³² The committee reports to Parliament on legally binding carbon budgets and related issues. In spite of the fact that all decisions are still in the hands of politicians, the UK example represents the first steps in the direction of what could become an expert group in line with the ideas of the flexible emission fee mechanism. This includes a legal framework for ensuring that Government meets its commitments by means of legally set targets and an independent body of experts.

Setting the fee is no tedious task: informational demands can be huge and trade offs difficult. In principle the expert group will have to consider multiple objectives at once, which makes it necessary to democratically develop a decision rule before the expert group is set to manage the fee and given responsibility of solving an environmental problem in a balanced way.

Uncertainty

A strong argument in favour of flexible emission fees is that it lowers uncertainty. A wellfunctioning futures market is assumed to reduce uncertainty of abatement cost implying that the flexible futures fee potentially can promote a reduction path where abatement costs are minimized and the destruction of capital due to abrupt changes is reduced. When a target is set without including environmental damage cost or there is no target at all,³³ the environmental uncertainty is removed from the decision making (not from the environment-economy interrelation).

On the other hand, mainstream environmental economics see decision making on uncertain basis (uncertain knowledge about present and future environmental and abatement costs) as a necessary evil. In order

³² www.theccc.org.uk

³³ The former could be no phosphorous imports in 30 years and the latter phase out of phosphorous imports without a specified goal in time, see also section 3.3.1.

to move the emission reductions towards an optimal target policy decisions must be made based on best available information.

This fundamental distinction – not between mechanisms as much as between economic reasoning is not possible to evaluate on present grounds.

Lastly, the expert group will be setting and adjusting the fee according to a set of attributes that are – more or less – known to the agents. The knowledge will provide that companies with a tool to generate expectation for the fee in the coming period. It is not clear precisely on what basis the expert group will make decision, but assuming that the process is transparent can lower uncertainties.

Rapid adjustment is a way to timely incorporate updated information, which can reduce risk of off target policies. The current debate on the EU ETS³⁴ reflects the difficulties in adjusting regulation based new information and changed conditions. The flexible emission fees are inherently adjusted which potentially reduces risks of malfunctioning. However, tradable emission permits could in principle also be adjusted much more frequent than in the current setup of EU ETS.

Transaction costs

In comparison with tradable emission permits, flexible emission fees require a well-developed futures market with a full set of financial middlemen. Although trading can be performed by a limited number of people and not all polluters have to engage in trading, it has to acknowledge that a futures market is not free of costs. Speculations – for instance on futures markets – can be regarded as beneficial as it evens out fluctuations and increases liquidity. Even if the transaction costs are low, speculators still need return on their investment, which everything equal shifts the cost curve upwards. Introducing volatility and risk is not free of cost.

In addition, a given polluter only knows own abatement costs and not that of other agent's; this implies that the single polluter is willing to pay an additional risk premium reflecting the likelihood that tomorrow's prices are likely to be both above and below the polluter's own cost. In other words, that polluter expresses his expectation for the future price on the market and what the price at the futures market is above his abatement cost. It should be seen as that insurance premium that he is

³⁴ European Commission (DG Climate Action) on structural reform of the EU ETS:
http://ec.europa.eu/clima/policies/ets/reform/index_en.htm

willing to pay to avoid uncertainty. It is not clear to what extent transaction costs will increase, but it is to be expected that the related costs will be relatively smaller in an extensive market with many polluters.

If the expert group has to adjust the flexible emission fee several times a year, it calls for a high level of information on actual emission levels, which is costly to attain. It will depend on the specific emission characteristics, but it could be a disadvantage for flexible emission fees compared with tradable emission permit mechanisms where stock of emissions can be taken at the end of multiannual periods.

On the other hand, when the fee or permit system is levied on imports, extraction or production of an unwanted substance information levels are generally high. Import statistics are available, which lowers monitoring costs. Furthermore, only few agents tend to be involved in imports compared to potentially many more agents down stream, which lowers administration costs. However, upstream taxation removes focus from environmental damages. It will thus be an import fee or permit system, rather than an emission system, which could lead to the same emission reduction but there will be no incentive to install a range of technologies (e.g. end of pipe filters and remediation technologies) potentially increasing costs of reaching an environmental goal.³⁵

This report does not include analysis of legal aspects of the mechanisms; neither whether flexible emissions fees are legally possible within existing framework nor if it will augment risk of too costly legal disputes between e.g. polluter and regulator.

4.2 Evaluation of analytical cases

The Swedish Environmental Protection Agency propose a combined a non-tradable cap and fee system to control phosphorus and nitrogen emissions. Emitters are assigned an emission cap, and if this cap is exceeded, a fee will be levied on the excess emissions. The fee revenues will be used to finance additional reduction actions.

The flexible emission fee proposal involves flexible import tariffs on food and fertilizer containing phosphorus and nitrogen as well as end-user fees on phosphorus and nitrogen emission fees on industry, com-

³⁵ If these technologies are applied the polluter could be given permit allowances or exemption from import fees.

bustion engines and agriculture. The fee revenues will be used for household compensation and infrastructure investments.

In general, the former proposal is focused on a narrow set of polluters and a specific environmental problem. The latter, on the other hand, suggests a set of different mechanisms to regulate the full value chain; or in other words the aim is to alter the way the nutrients flow through the economy.

Environmental effectiveness

Although both proposals are based on quantitative environmental targets a cap is a more environmental effective approach. A cap sets a legal limit on pollution, and even though a flexible fee can adjust according to observed emission reductions, the fee-setter still has to guess how much it will need to reduce emissions. When initially setting a fee, tax or cap, the same considerations will have to be made. The advantage of the flexible emission fee is that this can be adjusted regularly in response to the measured impact of the fee on the environment. However, in the Swedish EPAs suggestion, a cap is combined with a fee on excess emissions, which implies that neither of the suggested policy schemes give environmental guarantees.

As the flexible emission fee is levied upstream, it has high coverage of the down stream value chain.³⁶ Since the tradable emission permit proposal only involves a limited number of point sources the coverage is lower. This distinction has consequences for the ability of the proposed mechanisms to reduce emissions.

Another distinction is time horizon and target characteristics. The flexible emissions fee is aimed at full import phase out over a rather long time span as opposed to the tradable emission permit proposal that has a more pragmatic ambition of reducing excess emissions over a shorter horizon in time. The former is a price on imports that incentivises recycling (from reducing leaching and evaporation from manure to recollection of nutrients in water bodies), whereas the latter gives incentive for reducing point source emissions (more effective sewage cleansing but also remediation actions in water bodies). The differences in approach have consequences for the environment; the outcome of regulation could, in theory, be the same, but the paths to reach it and technologies applied are quite different.

³⁶ In addition, the flexible emission fee proposal.

Economic efficiency

The analysis covering economic efficiency might be more clear-cut. The Swedish EPAs proposed policy scheme does not, at its current form, involve a true cap-and-trade system. The suggested instrument is rather a combination of a traditional regulation and an emission tax. Thus, the proposed policy scheme does not result in any economic efficiency if the cap is a binding constraint, i.e. when the actual emissions are lower than the cap. The FEF on the other hand involves double-taxation if both upstream and end-user emitters are levied by a fee. Increasing food prices and household rebates drive inflation, which the FEF also recognises.

In addition, the upstream levying in the flexible emission fee proposal, cuts off a number of end pipe or remediation actions that could be more cost effective, such as increasing process effectiveness or recycling.

A flexible emission fee on both imports, but also on combustion engines and potentially end point emissions, are in reality different mechanisms. In terms of economic theory, policy diversity could be an adequate way to address the overall objective, which can be more cost effective than a universal approach. However, the tradable emission permit system could also be extended with other mechanisms in the same way.

According to economic wisdom, or rather tax incidence analysis, the choice of upstream versus downstream carbon tax or cap-and-trade is of no significance since the behavioural change should not depend on where in the production process the regulation is levied. Proponents of upstream cap-and-trade point to the much lower administrative costs of upstream regulation due to fewer entities to regulate. Behavioural economists criticise upstream cap and tax because the price signal from the cap is removed from the pollution point and the one who is in control of the emission. Although the imposition of a cap or a tax are argued to travel through the system to affect consumer prices, the lack of clear tax salience lead to less behavioural change.

An emission tax levied upstream closely resembles an upstream cap-and-trade system, where the price of allowances is passed forward to consumer prices. However, whereas a tax well could be levied on relatively few operations, a cap-and-trade requires the creation of new markets and a new set of openly traded commodities. It seems likely that this type of policy scheme would need to include more entities, and possibly a more downstream approach, to induce trade with allowances and thus result in an economic efficient outcome.

Dynamic efficiency

The policy scheme in the Swedish EPAs proposal consists of a non-trade cap with a fee levied on top. This means that the emissions regulated by the cap will be free for polluters. Emission levels exceeding the cap will be subject to a fee. This implies that the proposed policy will have the same effect on technological change as a traditional regulation as long as the cap is binding, i.e. actual emissions are lower than the cap. Hence, the dynamic effects will be negligible. If the actual emissions are higher than the cap and a fee will be levied on top, then the proposals by the Swedish EPA vs. the Foundation will give the same incentives to technological development.

Efficiency of redistribution of revenue

The two proposals differ in terms of spending (and generation) of revenues. The flexible emission fee is proposed in relation to redistribution to the public (but also for investments in sewage infrastructure). On the other hand, the tradable emission permits proposes to spend revenue on remediation actions. These two alternative ways of recycling fee revenues lead to different efficiency results, but also to different kinds of incentives of technology diffusion and in turn dynamic efficiency effect.

Predictability

A fixed cap and a long-term set emission tax would give more predictability than a flexible fee, despite the possibility to hedge against fluctuations on a futures market.

Acceptability

A green tax shift by financing decreasing personal income taxes with import tariffs could possibly be more public accepted than an intra-industry redistribution of fee revenues. However, import tariffs on food and fertilizers will most likely be claimed to be protectionism and render protests from WTO as well as from the EU. Furthermore, it will be difficult to differentiate between ecological and traditional food imports in terms of phosphorus and nitrogen, which also would affect the analysis on environmental efficiency as well as on transaction cost.

Transaction costs

Both policy schemes involve substantial transaction costs for set-up and monitoring etc. The monitoring of end of pipe emissions and recipient environmental concentrations etc. is costly, but it is not clear how the mechanisms distinguish themselves, as both suggest environmental monitoring.

The flexible emission fee based primarily on imports is not wholly dependent on environmental information, but if it expected that environmental trends is an important component of the decision to change fee several times a year, the monitoring costs would be substantial. Import statistics do, furthermore, report nutrients content of goods – it could be calculated for every single fertilizer and food, but this is not trivial task.

5. Results

The report compares flexible emission fees and tradable emission permits based on a set of criteria. The latter is used analytically to highlight differences between the proposed flexible emission fee mechanism and a well described and broadly applied mechanism. However, tradable emission permits faces challenges as expressed in the current debate on the future of the European Emission Trading System. The pros and cons of flexible emission fees are in focus, and efforts have been made to point out the particular advantages and disadvantages in comparison with tradable emission permits.

The results of the analysis of flexible emission fees are summed up in the following questions:

Are flexible emission fees at par with the framework for environmental regulation? A major driver of current environmental policy and legislation are challenges that require action to avoid irreversible damage or threats to human health. The polluter's pay principle is central in this environmental regulation. In cases where flexible emission fees operate without a specified target, it can be argued that the fee is a price on poorer than average technology rather than on pollution. The polluter will still pay, but there is only a very indirect price on pollution itself as damage costs of emissions are not priced. On the other hand, if a target is specified for the flexible emission fee, a price on pollution will be the consequence and, in this case, also be part of the futures market price.

Will flexible emission fees be preferred by consumers and polluters? The risk of increase in consumer prices and options for repayment are analogue for economic mechanisms for environmental regulation. Repayment of revenue is possible, irrespective of the mechanism that generates revenues. It is therefore to be expected that consumers have no general preference for one mechanism over the other. Polluters are said to opt for stable market conditions, but the argumentation that flexible emission fees with a future market will in fact lead to predictability at low cost has to be scrutinised formally for this to be substantiated. To the extent that flexibility reduces abrupt changes in fee, it will most probably be preferred by polluters. It can, furthermore, be expected that polluters are in favour of a fee that moves with average abatement costs, as this minimize their costs and leaves out accelerated action on envi-

ronmental grounds (emission reduction will occur at a market's preferred speed – disregarding externalities – when there is no specified environmental targets to reach). However, it is not clear whether polluters will be in favour of mechanism management by an independent expert group; it can potentially reduce their say in the process, but it can also reduce abrupt changes due to, e.g., political risk.

Case-specific factors of mechanism design and market structure are likely to influence the response by consumers and polluters. For instance, if the revenue is redistributed to development of new technology, it will increase the acceptance with some polluters. On the other hand, if the revenues are paid to the citizens as a lump sum transfer, it will create a positive opinion in the population. In addition, if the polluter is a price-setter, it can pass the burden on to the consumer, but if the producer is a price-taker, it will bear the loss and the consumer will experience a budget increase.

What elements are new? In many aspects, the flexible emission fee combines well known elements. The mechanism does, nonetheless, differentiate itself on some aspects: (1) a flexible emission fee without a specified environmental target differs from the general paradigm within environmental economics that optimal regulation reflects the intersection between the marginal abatement costs *and* the marginal damage cost to the environment; (2) introduction of volatility via fluctuating fee level in order to reach a new equilibrium opposes traditional regulation that aims at minimizing instability. At the present stage, it is not clear whether this dynamic is beneficial or not; and (3) the introduction of an expert group is also an innovative element that has some potentials in making qualified decisions with a long-term perspective, but it is also a major step away from present day political control. Any advantage of an expert group could also be found if applied to the management of other mechanisms.

With a specified environmental target (e.g., quantitative reduction at point in time), the FEF sends a clear quantitative signal to the market in spite of the fact that prices are used to regulate or interfere on the market. Nonetheless, this case shares extensive similarities with quantitative regulation (e.g., tradable permits) where small intervals of adjustments (of the number of permits) could be applied as well. However, this has not been prevalent in actual application of quantities mechanisms – one of the reasons being the difficulties in political decision-making that will only increase at greater frequencies; a matter which an expert group with operational independence could reduce.

With a flexible environmental target (some buffer as to quantitative reduction and point in time of achievement), the flexible emission fee resembles price regulation (a tax). During the period of regulation, new information from polluters, on the environment and so forth can be incorporated in the adjustments of price, which makes it continuously possible to optimize benefits and minimize cost. The benefits of flexibility in regulations have been presented often in economic literature. However, flexibility can come at elevated cost, not only to decision-making but also transaction, monitoring and administrative costs.

In which cases are flexible emission fees most attractive? The mechanism has potential strengths in cases (1) with high levels of low-cost information on effects as many adjustments require much information; (2) with long-term objectives where environmental damage is small and cost minimization is the top priority; (3) where the typical alternative is a ban and transaction costs are not prohibitive (e.g., very sensitive environmental challenges where regular monitoring and adjustments by an expert group are necessary to make sure emissions stay within narrow thresholds) and also (4) where there is a time lag between the political decision of the overall environmental legislative framework and the actual setting of targets (e.g., policies that originate in the EU and where the Member States subsequently are to design the national implementation), the flexible emission fee would allow regulators to quickly implement a fee without a specified target for the relevant emission or resources and only later determine the national target where the knowledge of the price for abatement which have been revealed at the futures market.

6. Recommendations

Following the results of the analysis and the process to reach them, several suggested recommendations for further development and assessment of flexible emission fees have surfaced. The list below can be regarded as progressive steps for future work.

- *Structured communication:* In discussions, communication and further analysis, it is of great importance to create a stringent framework for discussions. This implies that broader motivations for policy action (e.g., environmental concern, repayment to citizens, economic stimulus) have to give way for focused analysis of the isolated mechanism. Albeit important, the other aspects must be dealt with separately in order to maintain focus on the points where the flexible emission fee distinguishes itself from other mechanisms. It is recommended that the next step in communication and future development focus on flexible emission fees in a rather narrow sense.
- *Strict definition:* We regard it important to formalise the definition of flexible emission fees. This project has provided a structure and analysis that can be explored to a greater extent, and we recommend that contact be established to academia for formalisation in order to clarify argumentation. Furthermore, it seems reasonable to believe that a thorough literature study could result in additional insights into the efficiency of the instrument. Although flexible emission fees might be a uniquely used term in the literature, there is a lot of research along the same line such as “endogenous tax rates”, “dynamic corrective taxes”, “flexible pigovian corrections”, “discrete tax reform”, “dynamic taxation schemes” etc. A major step forward will be publication in a peer-reviewed journal.
- *Efficiency analysis:* A formal, theoretical analysis of the efficiency of futures markets in relation to flexible emission fees. It is crucial to establish a clear basis for assessing the trade-off between, e.g., efficiency losses of hedging on a futures market in terms of volatility of futures prices, risk premium, transaction cost etc. versus gains in flexibility and information revelation.
- *Cases:* Continue the development of the flexible emission fee on selected cases, e.g. based on the initial effects thoughts on the

nitrogen and phosphorous applications (TSSEF, 2013).³⁷ The development could aspire to reach the same level of detail as the work of the Swedish Environmental Protection Agency on tradable permits for nitrogen and phosphorous (e.g., Naturvårdsverket, 2012).³⁸

- *Empirical simulations*: Tests of flexible emission fee and futures market efficiency on given markets can show efficiency gains and losses and redistribution effects. The simulation should be calibrated with data from and the structure of selected markets.
- *Assessment of barriers*: An assessment of barriers for implementation must be carried out; this includes legal aspects, current environmental regulation, and consequences for trade and industry.
- *Convince politicians* to set legally binding environmental goals and to establish an expert group with operational freedom that can handle an environmental problem effectively and decide upon proper policy initiatives, be it taxes, tradable permits or flexible fees.

³⁷ TSSEF, 2013: "Briefing Paper – Flexible emission fees applied to phosphorous (P) and nitrogen (N)", The Swedish Sustainable Economy Foundation.

³⁸ Naturvårdsverket, 2012. "Styrmedel för ökad rening från kommunala reningsverk", Rapport 6521.

Dansk sammenfatning

Denne rapport analyserer økonomiske virkemidler til at sætte pris på forurening.

Med udgangspunkt i et sæt af kriterier (økonomisk efficiens, transaktionsomkostninger m.fl.) sammenligner analysen et forslag til fleksible miljøafgifter med virkemidlet omsættelige kvoter. Formålet er at afklare fordele og ulemper ved virkemidlerne, som er vigtige i den praktiske proces, der leder til valg af miljøregulering.

Omsættelige kvoter er velbeskrevne og anvendt i mange sammenhænge. Samtidig er anvendelsen forbundet med udfordringer, hvilket for indeværende ses på det europæiske marked for CO₂-kvoter. Analysen inkluderer omsættelige kvoter for at fremhæve forskelle og ligheder med fleksible miljøafgifter.

Fleksible miljøafgifter er bygget op omkring en uafhængig ekspertgruppe, der pålægger forurening en afgift, som varieres hyppigt nok til at opnå den ønskede reduktion i forurening. Som følge af variationen vil forureneren beskytte sig med fremtidige udsving i miljøafgiften på et såkaldt *futures-marked*.³⁹ Prisen på futures vil afspejle markedets forventninger til morgendagens afgiftsniveau eksempelvis baseret på udviklingen i de marginale omkostninger ved at reducere forureningen. Ekspertgruppen kan efterfølgende anvende information om prisudviklingen på futures-markedet i sin beslutningen om at fastsætte afgiftsniveauet.

Fleksible miljøafgifter bibringer nye elementer, der omfatter meget hyppig variation i afgiftsniveau, en uafhængig ekspertgruppe med operationel frihed til at forvalte miljøafgiften og indførslen af tilstrækkelig afgiftsvolatilitet til at afstedkomme en ny ligevægt (via futures-markedet). Ydermere er afgiften kun en indirekte pris på forurening eftersom fleksible miljøafgifter er tiltænkt at afspejle de marginale reduktionsomkostninger.

Disse elementer kunne i nogen grad indarbejdes i andre former for virkemidler og matcher i større eller mindre grad paradigmerne i da-

³⁹ En future er en kontrakt mellem parter om køb og salg af et værdipapir til en fastsat pris på et fastsat fremtidigt tidspunkt.

gens miljøregulering. Der er dog fortsat nøglespørgsmål, som står ubesvarede: Er gevinsterne ved fleksibiliteten og afledt stabilitet via en stærkt fluktuerende afgift større en omkostningerne derved? Dette spørgsmål kræver en formel økonomisk analyse, som kan afsøge de underliggende antagelser.

Fleksible miljøafgifter er blevet beskrevet både med og uden et fastlagt miljømål. Konsekvenserne af dette spænder fra et spørgsmål om omkostningseffektivitet – hvor forskellige virkemidler kan vurderet i forhold til deres evne til at nå et miljømål med færrest omkostninger – til en grundlæggende anderledes opfattelse af miljøregulering. Hvis det ikke er et fastlagt miljømål vil fleksible miljøafgifter drive forureningsreduktionen i en takt, der er sammenlignelig med udviklingen i forurenens reduktionsomkostninger, og dermed uden skelen til de skadesomkostninger som forureningen medfører. Denne tilgang kan potentielt minimere reduktionsomkostningerne, men den kan ikke optimere omkostninger og gevinster forbundet med et miljømål.

Overvejelser i analysen om de potentielle styrker ved virkemidlet er vist i tabellen herunder.

Table 4. Fleksible miljøafgifter kan have potentielle styrker i tilfælde med disse fire karakteristika

Høj grad af let tilgængelig information, da hyppige variationer kræver store mængder information.

Meget langsigtede målsætninger og lave skadesomkostninger som følge af forureningen, hvor minimering af reduktionsomkostninger har førsteprioritet.

Det typiske alternativ er et forbud og transaktionsomkostningerne ikke er uforholdsmæssige (fx meget følsomme miljøudfordringer, hvor hyppig monitorering og tilpasning fra ekspertgruppens side kan holde forureningen inden for et snævert spænd).

Lang periode mellem den politiske beslutning om rammeværket og den faktiske målfastsættelse (fx EU-regulering hvor medlemsstaterne efterfølgende skal designe den nationale implementering) kan fleksible miljøafgifter give mulighed for hurtigt at pålægge afgifter uden fastsatte miljømål og kun derefter fastsætte nationale mål baseret på bl.a. den viden om reduktionsomkostninger, der er opnået med fleksible miljøafgifter og afspejlet på futures-markedet.

Fleksible miljøafgifter er fremsat som et alternativ til den nuværende miljøregulering. Et regimeskifte foreslås både til fordel for forbrugere via tilbageføring af provenu, mindske reduktionsomkostninger for forurenere og udfase uønskede stoffer samt fremme genanvendelse. På trods af dette antager denne analyse, at den nuværende miljøregulering baseret på national og international lovgivning samt tilhørende politikker er uændret. Derfor ansues fleksible miljøafgifter som et uafhængigt virkemiddel på linje med andre eksempelvis skatter, administrative styringsmidler mv. Dette muliggør sammenligning af virkemidlet med andre anvendte virkemidler inden for den nuværende regulering.

Denne sondring er også gældende med hensyn til tilbageføring af provenu til forbrugerne, hvilket er foreslået som del af fleksible miljøafgifter. Analysen fremfører, at fleksible miljøafgifter ses snævert som et økonomisk virkemiddel, der kan sammenlignes med virkemidler med samme muligheder for tilbageføring.

Det anbefales at videre arbejde og formidling af virkemidlet fokuserer på den økonomiske kerne og ikke på den bredere motivation for miljøregulering eller anvendelsen af provenu. Kun ad denne vej kan virkemidlet vinde accept blandt lovgivere. Ydermere bør de økonomiske ræsonnementer underbygges og testes og et oplagt skridt er at etablere kontakt til forskningsmiljøer med henblik på publicering i fagfællebedømte, økonomiske tidsskrifter.

7. Appendix

7.1 Independence of governmental agencies and public acceptability

Public choice theory and historical evidence show that some governmental institutions can cause large damage on the economy if abused by governments. In addition, theoretical and empirical research show that governments indeed might have strong incentives to abuse these institutions. Whereas there is a trend to make some of these institutions independent of the government it is also argued that independence creates new problems regarding the accountability, responsibility, and legitimacy.⁴⁰

A central bank is a typical example of this type of institution. Research shows that governments face strong incentives to interfere with monetary policy for own short-run political gain, which can be harmful for society. It is argued that an independent central bank can run a more credible monetary policy, making market expectations more responsive to signals from the central bank. Since the 1990s, there has been a trend towards increasing the independence of central banks. The configuration and political say vary between countries, but generally central banks have to ensure stable prices and long-term stability in the economy. Central banks do not necessarily set their own goals, but they often have far-reaching operational freedom.

Trust in the institution is critical for the functioning of central banks; they are expected to deliver trustworthy decisions to the benefit of the whole economy. The public acceptability of a central bank will depend crucially on how well it defines and performs over time. The financial crisis and the bad performance of the independent central banks vs. the less-independent central banks have fuelled the debate regarding the efficiency and legitimacy of independency.

Another type of institution facing the same challenges, involves Fiscal Policy Councils. Albeit not commonly implemented, various forms of

⁴⁰ Kvasnicka, M., 2005, "Independence and Responsibility of Central Banks", *New Perspectives on Political Economy*, 1(2), 50–75.

Fiscal Policy Councils have been advocated by economists in recent years. It is argued that that the councils should advice, monitor and constrain government policy, and in some proposals even be delegated parts of fiscal decision making. A common proposal has been to delegate the right to adjust specific tax rates within pre-determined margins around some politically determined base level in order to stabilise the business cycle. The aim has been to increase effectiveness of stabilisation policy by reducing time lags and the risk that stabilisation motives are dwarfed by other objectives.

Not unexpectedly, technocratic influence on fiscal policy is controversial. Whereas critics have argued that the freedom of action of democratically elected politicians would be circumscribed in a non-acceptable way, others argue that distortions in the political process, such as political rent seeking, would be counteracted and policies more aligned with public preferences would be promoted.⁴¹

To some extent the above reasoning can be paralleled with a flexible fee-setting expert group. Monetary, fiscal or environmental policymaking could all to a varying degree be distorted by self-interested politicians, lobbying, excessive discounting of the future and time inconsistency problems. Under some conditions technocratic decision-making by independent expert could be more efficient. Whereas the advantages of independent central banks seem generally accepted, delegating fiscal policy to independent experts are highly controversial. Whether delegating decision-making on environmental taxes would be accepted or considered provocative remains to be seen, but it seems likely that a proposed reform would be subject to intense discussion.

Notwithstanding the unwillingness for politicians to give away power to influence fundamental economic decisions, such as employment, inflation, and industry framework conditions, there are also other issues that should be considered. Whereas a central bank not established to generate revenue for government budgets, a fee-setting expert group, and some forms of fiscal councils, has a direct effect on revenue. This could possibly make the latter experts more subjective to outsider pressure. In addition, whereas the interest rate has economy-wide implication, could the effects of emission fees be concentrated on a very limited number of stakeholders. For pollution concentrated to a smaller industry fraction, the fee-setting expert group's decision could have significant influence

⁴¹ Calmfors, L, 2005, "What remains of the stability pact and what next?", Sieps 2005:8.

on bottom lines. In these cases, it is likely that industry will not accept giving a full mandate to the expert group.

Finally, whereas an unfavourable monetary policy for national competitiveness could be motivated by national inflation or stability reasons it is harder to motivate an industry-harmful emission fee when environmental benefits are global and the fee opens for international distribution of burdens.

Two approaches to pricing pollution

This report compares the Cap and Trade method with an alternative method, the Flexible Fee Mechanism. The Flexible Fee Mechanism was created as a response to political and other practical obstacles often preventing the efficient application of other methods.

The main focus of the Flexible Fee Mechanism is the levying of a fee at the point where a pollution-inducing product enters the economy. The fee is then raised sufficiently (and sufficiently often) to effectively stimulate the transformation of the economy in a sustainable direction. At the same time, the revenue from the fee is directed back into the economy to stimulate alternatives, demand and employment.

Still, key questions remain unanswered in this report. This project was launched by the Working Group for SCP (HKP) in collaboration with the Working Group on Environment and Economy (MEG) under the Nordic Council of Ministers.