Flexible emission fees

An incentive for driving sustainable production and consumption


norden

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Content

Preface

We are facing a dilemma:

On the one hand we need to continue to ensure that our economy is sound, preferably with continued growth in the economy and increase in prosperity.

On the other hand we need to transition our economic activities into a mode that halts climate system disruption, ensures that precious elements like nitrogen and phosphorus are recycled responsibly, and uses fossil energy supplies sparingly.

We need research and practical proposals, debate and discussion into how this transition can be managed within the framework laid down by scientists and authorities, and within real targets laid down by decision makers/politicians.

If we introduce regulations too strict and too early, we risk undermining the economy and the prosperity we enjoy. If we introduce measures too late, we risk undermining our economy with the extra burden of investing in technology when we do not have the resources to do it.

We need a discussion based around: how can we reorganize our financial system so that it can continue to perform its essential functions – reinvesting savings into environmentally and socially beneficial projects – in the context of e.g. declining energy supplies, eutrophication and ecosystem services.

The Nordic Council of Ministers has chosen as a starting point for the discussion to finance a first phase of a project with focus on the flexible emission and discharges fees mechanism proposed by Höglund. The mechanism was chosen since it represents a high-tech approach to the economy, and because it incorporates many of the proposals already being put forward by a broad range of experts, institutions and businesses. The benefit of the Höglund mechanism is that the combination is new. Of interest, is that the proposed mechanism for flexible emission and discharges fees is not a substitute for existing ones, e g, the Emissions Trading System – it is more a complement and has a broader scope also covering, e g, discharges to water.

Stefan Nordin
Working Group for Sustainable Consumption and
Production of the Nordic Council of Ministers

Summary

Putting a price on pollution is still a rather undeveloped practice. Doubts have been raised about its effectiveness and its negative impacts on economic growth. Emissions are still growing and it is vital that practical mechanisms continue to be explored and the techniques refined.

A Flexible Emissions Fee Mechanism has been proposed by Anders L Höglund. This mechanism aims to ensure that market actors comply with emissions targets whilst ensuring that the rate of technology transition does not undermine the actors' economic stability, stunting economic growth. On the contrary, since the income from the fees levied can be channelled back, new technology and sustainable production and consumption can be stimulated, and conditions for beneficial growth can be ensured.

With Höglund's suggested mechanism for "Flexible Emission Fees" as a starting point, the Nordic Council of Ministers assigned the project to look further into the possibilities of developing the concept. The main goal of the project has been to increase the understanding of flexible emission fee setting, answering the following question: "Can flexible emission fees be implemented to abate CO_2 emissions whilst, simultaneously, stimulating technical and economic development?"

The project is in two parts; a literature review and a workshop with invited and experienced participants.

The literature review shows that the concept of a flexible fee, as described by Höglund, is unique. Therefore no or very limited discussion on the topic has been found in scientific journals. The differences between a tax and a fee need to be highlighted. A sufficiently flexible and budget neutral CO_2 fee with a full rebate could be a major step towards a solution to the potential juridical and political obstacles. To evaluate this concept and it's democratically viability should be given a high priority.

The project group felt that the majority of participants viewed the mechanism as having the potential to reverse the trend of emissions, particularly in the areas presented in the workshop: CO_2 and phosphorous. It was also generally accepted that new mechanisms, to complement those currently available, need to be tried as the situation is urgent. This was echoed by the speakers Karl-Henrik Robert, Johan Rockström and Arno Rosemarin. Stefan Fölster claimed that government distribution of fee income is more efficient than the general rebate proposed by Höglund. Fölster was positive to further development of the Flexible Fee mechanism and a prototype test in an area not covered by emission trading.

The questionnaire and group sessions showed the project group that drivers include the positive economic effect of feeding back fees into the economy, the stimulus on clean-tech development, putting a price on pollution, and that a hedge market could arise. Barriers include the difficulty of communicating the model and gaining acceptance, and the need for a better understanding of how to deal with trade between nations. None of the barriers indicate that flexible fees will not work. Future projects should investigate the impact of these barriers and how to overcome them.

The Workshop and its breakout sessions generated a number of general views, recommendations and agreed conclusions. The results from the questionnaire (filled in by the workshop participants) can be shortly summarized as follows:

- Flexible fees can engage market forces to focus on emissions and externalities (4), reverse the trend of ecological services degradation (5), represent a method to put a price on pollution (6), should be levied on potential pollutants at the national entry/extraction point (12), will be strongly supported by environmental activists (14), can stimulate demand for clean tech and recycling (19), and will cause a future market to arise where actors hedge against (20)
- Flexible fees are difficult to understand (7), will not be easy to implement (8), will not be accepted by business (10, 15) and will hinder the trade between countries and continents (22)

The project group, based on these conclusions, recommends that the work continues to present the mechanism and one or two case studies to more stakeholders in more Nordic countries to gather feedback documented in a full written report that considers the way forward with wider consultations or small scale test implementation.

Introduction

It is widely accepted that putting a price on pollution is one way to curb it. However, the practice is still rather undeveloped and doubts have been raised about:

- Effectiveness
- Negative impacts on economic growth

It is therefore vital that practical mechanisms continue to be explored and the techniques refined.

The flexible mechanism explained

For substances that are accumulating and unacceptably degrading natural systems and/or being unavailable for re-use, governments should levy a fee. This fee is levied as far up the supply chain as possible, preferably at point of import. The size of the fee is flexible and changed frequently, depending on if the change is going faster or slower than target. If change is going slower than target, the fee is raised, aiming it to be sufficiently high to affect a change in market behaviour.

Revenues from the fee go back into the economy as a general refund to further public acceptance and to stimulate spending.

For further explanation of the flexible fee mechanism, please see Appendix 4. More information and wider discussion is available in the White Paper in Appendix 2. Presentations and further background material are on the home page of the Swedish Sustainable Economy Foundation (http://tssef.se/?p=270).

The potential of flexible fees

The potential advantages of the Flexible Fee approach are many, including the avoidance of forcing established actors to, prematurely, re-invest in totally new technology and to scrap earlier investments. By retaining technology and infrastructure during a transition phase and adding these control mechanisms, businesses will have time to adapt whilst retaining economic stability.

The emissions fees should be high enough to change supply chain and consumer behaviour, leading to sustainable production and consumption. One essential feature of the Höglund Flexible Fee Mechanism is the repayment of a sufficient share of the revenue, from the fees, to the indi-

vidual consumers, ensuring the majority of the population to benefit from the system.

One important aspect of this "clean tech through control" approach is the ability to apply stabilizing feedback control to previously unstable processes and systems. Applying the Höglund approach to regulating emissions would mean creating a mechanism whereby emissions fees are flexible, and to a certain extent, unpredictable, rather like interest rates. In practice, the approach calls for an emission monitoring mechanism to be set up, and a system to charge and change fees on a regular basis. The level of fee will be set according to how well emission reductions correspond to targets. If they are above targets, the fee is raised. If they are below, the fee remains unchanged or is lowered.

Revenue from this system can be used to stimulate the development and spread of technologies and equipment that emit less.

The genuine uncertainty generated by the flexibility of the fees would stimulate the development of futures markets and attract the scrutiny of the financial community that invested in them. This is an important area of study for sustainable economics, and mechanisms to address the well known problem of externalities.

Need for further investigation

Specifically, past investigations have concentrated on economic analyses and simulations. How people and markets react in reality can differ. Some examples of unanswered questions include:

- Will companies invest in clean technology if high emissions fees threaten?
- Will the fees get diverted to stimulate new investment?
- Will the flexibility of the fees be easy enough for government departments to run?
- Can economics be applied to stimulate sustainable consumption and production?

Initial feedback from administrations and industry is positive. Investigating flexible fees further, would give the Nordic Region unique insights into the potential of using fees to meet emissions targets, their drivers and barriers. Especially the production of a specific case story that has elicited the viewpoints of all actors involved The Nordic region could influence development and spread of these fees globally.

1. Description of the project

The project proposal, which was approved in April 2010, was scheduled to consist of three phases, of which Phase One was initially approved by the Nordic Council of Ministers. The three phases according to the proposal are;

Phase One (2010, pre-study) consists of the investigation, through a full one-day workshop with representatives from various stakeholders, of the case study that exemplifies the mechanisms of flexible emissions fees for CO2-emissions, and to compare with other approaches. Based on the feedback from the workshop, a report will be published and distributed to all stakeholders. The theme of the workshop will be:

- How would the mechanism work?
- What would be the drivers and barriers seen from your perspective?

Phase Two (2012) will see the case being studied in more Nordic countries and by more stakeholders and a full report written.

Phase Three (2013–>) is where the case, the findings and recommendations are put before a wide Nordic audience for feedback and comment. Bloggers who specialize in environment, economics, and social responsibility will be invited at this stage.

This report describes the Phase One results. The project consists of the following three parts:

- A literature review of the present research
- A workshop
- A report

The Project group has during 2010–2011 consisted of

- Magnus Enell. Project Leader. Adjunct Professor and Senior Advisor. Royal Institute of Technology (KTH), Department of Industrial Economics and Management, and Industrial Ecology, and Vattenfall AB
- Stefan Nordin. Swedish Agency for Economic and Regional Growth, and also a member of NCMSCP
- Stephen Hinton. Swedish Sustainable Economy Foundation
- Anders Höglund. Swedish Sustainable Economy Foundation

According to the project proposal, also a Reference group with one representative from each of the countries Denmark, Finland and Norway was identified. However, the participation of these persons was limited, and the Reference group did not conduct any constructive contribution.

1.1 Performance of the project

Vattenfall Management Consulting (VMC) has been the host for the project, and Magnus Enell has been the acting Project leader. Magnus position at VMC is Senior Advisor, but Magnus is also acting as Adjunct Professor at the Department for Industrial Economics and Management, Royal Institute of Technology, KTH, Stockholm, Sweden. Magnus role in the project has been as the Adjunct Professor at KTH.

1.1.1 The Literature review

The literature review was done by Ph.D. student Fabian Levihn at the Department of Industrial Economics and Management at the Royal Institute of Technology, KTH, Stockholm, Sweden.

1.1.2 The Workshop

Because of reasons, that are not fully evaluated, the conduct of the workshop was not an easy issue, since the initial interest for participating in the workshop was limited. The invitation to participate in the workshop was directed towards persons that already had shown interest connected to climate change, Clean Development Mechanism, Emission Trading Scheme, Emission Fees etc. The workshop was not intended for participants just to listen and learn. The purpose was to get participants with knowledge, experiences and authorities within the area.

After having cancelled planned workshops in December 2010 and May 2011, the Workshop was conducted in September 2011.

1.1.3 The Report

The literature review and the workshop, together with the follow-up review, has given light on the opportunities for the Nordic region to introduce the mechanism in selected areas and possibly lead the world in emissions reductions and the development of clean tech stimulated by economic mechanisms.

The main goal of the project has been to increase understanding of flexible emission fee setting, answering the following question:

> Can flexible emission fees be implemented to drive CO2 pollution down whilst stimulating technical and economic development?

The workshop presented a simplified case, illustrating the application of flexible emissions fees to drive sustainable consumption and production. By working through the case and giving feedback, the workshop effectively mapped the perception of the wide range of stakeholders involved as to the benefits, drivers and barriers to its introduction.

If flexible fees are a way forward, the project with its workshop, has prepared the ground. If barriers are perceived as too high, or efficacy too low, these results will inform further studies and opinion.

2. Results of the project

2.1 The Literature review

The review present research on emission policy and its implications in a climate change context. The theory is then used for evaluating a flexible fee mechanism proposed by Höglund. The review starts by introducing the reader to the project and Höglund's flexible fee mechanism and then moves through the background of the problem with CO2-emissions, corresponding market failure and the history of present policies. In the last chapters different solutions that might be adopted to counter this market failure and finally theoretical considerations for Höglund's approach is discussed.

The literature review shows that the concept of a flexible fee, as described by Höglund, is unique. Therefore no discussion on the topic has been found in scientific journals.

From Chapter 7.10. Conclusions, the following text is taken;
The truth about environmental policy is that there is no consensus of a policy that is always the best for all situations. While some argue for a cap and trade system like the EU ETS, others see a tax as more efficient. Decisions on policy instruments are often based on political factors and regional preferences. Research has shown that in theory, an optimally set tax and trading scheme would in many respects correspond to each other and has the same outcome.

A flexible fee system would optimally in theory have similar outcome to both a tax and trading system. In reality, no system performs optimally and EU ETS is no exception. Here feedback from futures trading could improve upon present ways of setting tax levels or caps and thus add overall efficiency to the system. Research has shown that sometimes futures markets are very effective at price discovery and short term risk transference. If unbiased, such system would improve environmental policy making and would be applicable for other environmental causes than global warming, such as phosphorus depletion.

During implementation, some policies are also expected to be more fiercely lobbied against than others depending on how they are perceived by corporations and different countries. All polices have their strengths and weaknesses. Still there are some aspects while designing a policy which contributes to making them more efficient.

Corporations are generally today positive to the introduction of climate policy, but are dissatisfied with present systems. These are seen as ineffective, inconsistent and unclear. Especially sending long term signals is asked for to provide incentives for investments in R&D. While

considering investments, corporate leaders must take into account the perceived future, sometimes as much as more than10 years ahead. But long term commitments do not only reduce policy related risks affecting investment decisions, it also makes it possible for corporations to plan and implement response to new policy in advance.

When implementing new policies there should optimally be one policy implemented per goal to be achieved. Policy is also most efficient if directed directly at the source for achieving this goal. If one policy is directed at actual emissions, another is needed to stimulate a parallel goal of technological development. For example one policy might put new products on the shelf, while another creates a demand for taking them of the shelf and into a market. If there are parallel policies with the same goal, efficiency is gained when policy outcome is harmonized.

In a climate change context the costs and possibility for different abatement options to be performed differs. To achieve economic efficiency and social utility it is important that abatement is performed where marginal abatement costs are lowest at first and options with higher costs last. Therefore optimal policy should be designed to provide incentives for capital to be invested in low cost options. This also adds to the need for parallel systems to be harmonized as to direct resources in the most efficient way. If policies are not at level investments will be made where relative policy pressure is highest and thus lead to economic inefficiency.

Hypothecation or earmarking of taxes and fees is asked for by many corporate leaders. During the process with this study it has come clear that there is often a lack of understanding from both corporations and researchers of how political and juridical obstacles affect different policy and the possibility to implement them. Even though many of the reports included in this study gives advice for policymaking only a few discuss this matter.

The political framework in Europe makes a harmonized tax hard to implement as all member states must support it. The framework also counteracts earmarking of capital raised by taxes. This affects the possibility to design and implement many policies. In the same way juridical and political process counteracts frequent adjustment of a tax.

The differences between a tax and a fee need to be highlighted. A sufficiently flexible and budget neutral CO2 fee with a full rebate could be a major step towards a solution to the potential juridical and political obstacles. To evaluate this concept and its democratic viability should be given a high priority.

Mapping these obstacles would therefore be a valuable addition to present research and would provide a basis for how and which policies should be included in mathematical and economic modelling. Today corporate lobbying and resistance is often included in analysis and discussion of policy instruments, but the political dimension left out. An increased understanding and mapping would add a more important perspective to this.

Many researchers as well as corporations argue that international competition calls for harmonized or international emissions policies. One

way to counter regional differences in policy is utilize border adjustments. The basic idea is to let corporations deduct costs induced by climate policy while exporting goods at the same time as imported goods are target of costs harmonizing policy induced prices with those of internal production. The theory of border adjustments to decrease regional influences on competition should be analyzed and modeled more thoroughly in a European context. Also the influence of international trade agreements needs to be added to the discussion.

Fabian Levihn's full report is presented in Appendix 1.

2.2 The Workshop

The workshop was held in Stockholm, Sweden, on September 15, 2011, as a full-day meeting, consisting of speeches by five invited speakers, and after that breakout sessions. All the five speakers focused their presentations to give their views on the concept Flexible emission fees, linked to the Höglund mechanism.

The workshop was intended for persons that are already involved in research, development and practical work connected to the possible application of flexible emissions fees. This includes both emissions to air and discharges to water. To optimize the result of the workshop discussions and breakout sessions a limit was set at 50 participants, well distributed between different stakeholder groups.

The workshop was attended by 35 persons, representing the following stakeholders; academia/research, business, authorities, politicians, consultants and non-governmental organizations (NGOs).

The workshop was started with an introduction made by Anders Höglund, the initiator of the suggested mechanism and theory, followed by presentations of the following well-recognized and in the topic involved persons:

- Stefan Fölster, Chief Economist, Confederation of Swedish Enterprise
- Karl-Henrik Robert, Founder and Professor, The Natural Step
- Johan Rockström, Executive Director, Professor, Stockholm Resilience Centre
- Arno Rosemarin, Senior Advisor, Stockholm Environment Institute (SEI)
- Anders Wijkman, Senior Advisor, Tällberg Foundation, Stockholm Environment Institute (had to cancel his participation in the morning the same day as the workshop was held)

In spite of a comprehensive ambition from the Project group and by invitation to engage participants and presenters from Denmark, Finland and Denmark, the interest in the workshop was somewhat limited.

After lunch the workshop was working in breakout sessions, focusing on discussing and answering key pre-presented questions. The workshop

was ended with a one hour session summarizing the day, conclusions for how to continue with the flexible fees mechanism and the future steps.

Before the workshop, all participants got access to two fact sheets, dealing with:

- Flexible Control Fees with Repayment, see appendix 4
- Beneficial Effects from Flexible Control Fees, see appendix 5

The Höglund mechanism and validity of statements

The participants of the workshop were also before the meeting supplied with a bullet list of the main elements of the Höglund mechanism:

A fee placed on import or extraction of substances that are accumulating in a way as to deteriorate natural systems and/or being unavailable for re-use.

The fee is placed as far up the supply chain as possible, preferably at point of import.

The level of fee levied is determined by the behavior of the market and changed frequently: if the market changes behavior to cease emissions/recycle the substance with the reduction time frame laid out by authorities, the fee is not changed. If the phase out goes faster or slower than target, the fee is adjusted taking as many factors into consideration as possible.

The levied fee is redistributed back to the economy to bolster spending.

A futures market for the fee is allowed to arise to focus markets on the economic significance of these substances and to allow the power of the open market to support the transition.

The workshop tested the validity of statements about control fees and their flexible application with refunding and the statements include:

- Control fees can be applied flexibly, universally and cost effectively to all targeted substances
- Simple ways are available to refund revenue from control fees back to citizens
- By refunding control fee revenues to citizens, national budget neutrality is achieved, and economic growth is not affected
- Determining the size of control fee by the actual rate of change in emissions against target can drive resource demand and management
- Flexible control fees with refund can be seen as a natural development of well-proven carbon dioxide fees along the Swedish model as well as an extension of tried and tested flexible congestion charges
- Introduction will affect consumption patterns of demand throughout the economy and increase the relative competitiveness of services and products that are provided in a sustainable way
- A general refund would favourably advantage those with lower incomes, stimulating consumption

- As most voters would gain from control fee refunding it would be politically and democratically easy to introduce the system
- General refunding means that it is politically possible to introduce emissions fees at a sufficiently high level to make a real impact on how the resource and its emissions are managed
- The level of emission fee charged will, eventually, arrive at a level just above the cost of managing the resource without emissions/accumulations. It will always be financially advantageous to manage resources in a sustainable way
- The fee mechanism, handled right, has the potential to drive development of solutions to the environmental and resource challenges Sweden and the rest of the world currently face
- The method can work in national and international markets

2.2.1 Viewpoints of invited speakers

Stefan Fölster, Chief Economist, Confederation of Swedish Enterprises claimed that government distribution of fee income is more efficient than the general rebate proposed by Höglund. Fölster was positive to further development of the Flexible Fee mechanism and a prototype test in an area not covered by emission trading.

Karl-Henrik Robert, Founder and Professor, The Natural Step, was of the opinion that:

- There is no silver bullet, but combined with robust sustainability on the table and a balance between magnitude and timing of prizing, flexible fees offer an elegant pragmatic means for policy making to support strategic sustainable development
- Flexible fees would benefit from:
  a) Further exploration of underpinning assumptions, e g, a fairer outline of green taxes
  b) Exploration of other objectives than those linked to flows, e g, halting encroaching and mismanagement of fertile land and waters, and a "humanization" of the economy. You cannot play chess against one principle of checkmate at a time
  c) Exploration of the landscape for policy making, and how this could be improved for the implementation of flexible fees

Johan Rockström, Executive Director, Professor, Stockholm Resilience Centre:

> "We have reached the maximum." Professor Johan Rockström at Stockholm Environment Institute used just one diagram to illustrate the urgency of curbing emissions with powerful mechanisms like Flexible Fees. His message was stark and uncompromising: we have reached and in some cases gone over Earth's limits to carrying capacity and into a rapid degradation of natural systems and resources.

Arno Rosemarin, Senior Advisor, Stockholm Environment Institute (SEI):

> "The strength of flexible fees is that the small consumer that goes green can be rewarded. With today's fee system, e g, for fuels, water and electricity, efficient end-users get no rewards and only make it cheaper for the larger consumers. Phosphorus-use efficiency is something that needs drastic improvement since only 20% of the mined phosphorus ends up in the food we consume. So there are many levels along the chain from mining to fertilizer production to fertilizer use, food production, food choices and consumption and finally waste treatment and reuse where various economic instruments can be implemented. Flexible fees connected to choice of food (beef versus fowl) and the amount consumed is one area worth exploring. Even the whole area of solid and liquid waste is worth looking at since this has a utility-based fee structure."

	Flexible emissions fees… **Please circle the response to the following statements that best agrees with your own personal viewpoint.**	**Disagree com pletely**	**Partly disa-gree**	**Partly agree**	**Agree com-pletely**
1	have the potential to stimulate the market to reduce emissions within a reasonable time frame				
2	can stimulate job creation				
3	can impact economic growth positively				
4	can engage market forces to focus on emissions and externalities				
5	can reverse the trend of ecological services degradation				
6	represent a method to put a price on pollution				
7	are easy to understand				
8	are easy to implement				
9	will be popular with the general public				
10	will be accepted by businesses				
11	will be accepted by the finance industry				
12	should be levied on potential pollutants at the national entry/ extraction point				
13	should be channelled back to all tax-paying individuals				
14	will be accepted by environmental activist groups				
15	will be accepted by the vehicle industry				
16	are something that Government agencies possess the skills required to introduce				
17	are something Companies have the skill to adapt their strategy to				
18	are something I can imagine promoting in my own organization				
19	can stimulate demand for clean-tech and recycling				
20	will cause a futures market to arise where actors hedge against				
21	will allow companies to transition to sustainable technology without premature destruction of companies and the capital behind them				
22	will not hinder trade between countries and continents				

2.2.2 The Questionnaire

The workshop participants were, at the end of the workshop, asked to fill in a questionnaire with 22 questions, according to the list below.

2.2.3 Questionnaire results

Results of the questionnaire are illustrated in the enclosed figure (end of the report). In the evaluation, Disagree completely and Partly disagree is aggregated as Disagree, and Partly agree and Agree completely is aggregated as Agree.

100% support

- 5. Can reverse the trend of ecological services degradation
- 14. Will be accepted by environmental activist groups

75–99% support

- 1. Have the potential to stimulate the market to reduce emissions
- 4. Can engage market forces to focus on emissions and externalities
- 6. Represent a method to put a price on pollution
- 9. Will be popular with the general public
- 11. Will be accepted by the finance industry
- 12. Should be levied on potential pollutants at the national entry/ extraction point
- 17. Are something companies have the skill to adapt their strategy to
- 19. Can stimulate demand for clean-tech and recycling
- 20. Will cause a futures market to arise where actors hedge against

50–74% support

- 2. Can stimulate job creation
- 3. Can impact economic growth positively
- 13. Should be channelled back to all tax-paying individuals
- 16. Are something that Government agencies possess the skills required to introduce.
- 18. Are something I can imagine promoting in my own organization
- 21. Will allow companies to transition to sustainable technology without premature destruction of companies and the capital behind them

<50% support

- 7. Are easy to understand
- 8. Are easy to implement
- 10. Will be accepted by businesses
- 15. Will be accepted by the vehicle industry
- 22. Will not hinder trade between countries and continents

In conclusion, the results from the questionnaire can be summarized as follows:

- Flexible fees can engage market forces to focus on emissions and externalities (4), reverse the trend of ecological services degradation (5), represent a method to put a price on pollution (6), should be levied on potential pollutants at the national entry/extraction point (12), will be strongly supported by environmental activists (14), can stimulate demand for clean tech and recycling (19), and will cause a future market to arise where actors hedge against (20)
- Flexible fees are difficult to understand (7), will not be easy to implement (8), will not be accepted by business (10, 15) and will hinder the trade between countries and continents (22)

The breakout sessions were documented by a "secretary" that compiled the two group's general views, recommendations and agreed conclusions. The Meeting Minutes were compiled in Swedish and that is the reason for why the continued text below is in Swedish. However, in Appendix 7 a Google translation to English have been done.

2.2.4 Report from Break-out sessions

The discussion led to the following general comments, summary views and recommendations;

- Clear long term targets set, gaining general acceptance, are seen as critical to beginning the introduction of flexible control fees
- Many in the panel share Karl-Henrik Robert's view that society has caught the "the disease of non-sustainability", ie that our way of life degrades the environment and will affect future generations by not affording them the chance to have a decent standard of living
- Some details in the description of the model was felt to be unclear, particularly how a futures market can put a price on what it costs to not pollute
- A bureaucracy that set fee rates is accepted as viable, but how a futures market can be connected to the size of the fee was somewhat less clear
- How financial markets work is somewhat unclear to the average person
- Several participants pointed out that the psychological aspects and signals are important to consider
- The Panel would like to see evidence that the system does not cost more than it generates, including the costs for futures trading, and the administration fees for introduction. This given that there is reason to believe that it can be done cost-effectively as emissions trading as we know it only needs a few people for the administration. The amounts can typically be 1–2 billion per person for administration

- The introduction of a flexible charging system can be facilitated if economists, business economists and humanists help out with language and their points of view to gain wide acceptance
- Consumer Democracy and thus the basis for the demand is a strong argument for distribution of fees back to taxpayers. It gives each part of the feedback fairly, and does not favor a particular group through subsidies. It is seen as an advantage of the mechanism that it is democratic in that way. However, some members believed that a certain portion of the should be distributed by decision makers to stimulate their involvement in the establishment of flexible control fees
- One advantage of the Flexible Fee is that it combines the fees with redistribution to the population. Thus, Flexible Fees do not have the negative social impact that most environmental policy instruments which limit the poorest in society most and less for those with more resources. Flexible Fees' redistribution of charges directly to the population (per capita) gives an equally high nominal increase of every citizen's purchasing power. Instead of the social distortions in the community are taking this environmental policy instruments and increasing purchasing power in percentage terms, most of those with the lowest incomes. This increased purchasing power is then steered to a greater extent to services instead of products as compared to today
- Another advantage of Flexible Fees instrument could be its futures market, but there was a group split into enthusiastic supporters and a slightly more neutral group
- Flexible Fees instrument with its relatively frequent corrections means effects on sectors of society will be dampened
- A problem with Flexible Fees that was highlighted by some of the group – that an implementation nationally in Sweden would soon knock out Swedish industry, such as pig-farming. One explanation given by the supporters of the steering instruments is that agricultural land prices follow naturally up and down with such a situation, while others in the discussion highlighted the commercial reality, farmers are in long-term debt to be paid continuously and low profit margins. Although the steel industry's international competitiveness was discussed, in which an increase of costs of 1% can lead to a production decline of 3%
- Members of the group also raised that Stefan Fölster's problems with steering instruments from the the morning session must be resolved with A) clear vision, B) competition with other countries (imports, exports, EU legislation and management instrument internationally perceived as trade barriers), C) acceptance in order to enable implementation and finally D) administration costs linked to the control instrument
- To allow an implementation of the governing instrument it is proposed to find areas of society where environmental regulation is not working. Introducing the new policy instrument should be easier

there. One such area that was mentioned in which success was not unwanted was pesticides tax in general. It is complicated, however, in the creation of instruments to define tax subject and object

In addition, a summary of the workshop group discussions from a few different aspects and views if offered below.

Psychological aspects and views
A few examples:

- The population in Sweden has developed a behavior in terms of recycling, although there is no great financial gain for them to do it. Some behaviors just need a little push, such as a change in the price level, for a change in behavior is noted
- Furthermore, there are examples where environmentally friendly behavior is hardly observable in spite of a low price, resulting in a slow change
- Another psychological effect is the status of the concept. If it gives status to drive an electric car (as-only costs about 2 € / mil, as stated by a participant in the panel) more would like to buy such a car

The impact of tariffs, the EU competition rules
A few examples:

- In the panel there was confusion about whether a high fee would affect imports, exports, etc. For example, an upstream charge on phosphorus would stimulate domestic economy and recycling while promoting affordable "stealth importation" of phosphorus by importing products using phosphorus in manufacturing
- Many areas are taxed with different instruments. The panel was unclear about where to begin to test the mechanism further. Perhaps within a small area that has not been regulated presently

Economists' point of view
A few examples:

- Research in the field of redistrobution mechanisms shows that it is more efficient to redistribute income via targeted subsidies and grants for research
- However, it may be more politically popular to return it to everyone's private account
- Other views are that a fee once mandatory, by definition, is a tax

The scientific point of view
A few examples:

- That today's extraction from nature and emissions into nature, relative to the increasing number of people on earth, means the way we live and consume natural resources has reached a peak. That we will find it increasingly difficult to survive unless we begin a rapid adjustment process
- That goal, from a scientific point of view, is clear and that all activity in the society must adapt to within the next 50 year
- If Flexible fees can accomplish this, at the desired rate, then it is welcome and should be tested immediately

Innovation point of view
A few examples:

- It is perceived as very difficult to find investment for innovative companies. To distribute funds to an innovation fund for technology that eliminates pollution or unwanted accumulation in nature would be welcomed
- At the same time, it was clear that pollution would become more expensive over time with the fee system if not stopped, this would make it much easier to find venture capital
- In general, íf flexible fees compel nations to take a small step before others, in terms of technology; it provides a competitive advantage over other companies in the marke
- Innovation companies are in favor of the fee system, in particular if it can rapidly increase interest in investment

Consumer perspective
A few examples:

- Some of the panel felt that money from environmental fees went to general welfare and if some services became more expensive, it would suffice and consumers would favor such a proposal
- Others feel that the money from environmental taxes, paid into, for example, their tax account would be incredibly positive and encourage them to support environmental charges more
- Consumers are generally positive to the charges and "polluter pays" and to explore ways to ease their conscience and to make environmentally friendly products cheaper

Business perspective
A few examples:

- Companies prefer stable conditions with regard to taxes and fees. If the introduction of increasingly stringent limits could mean more uncertainty, especially if a futures market would fluctuate, companies would be against the system
- However, if it was possible to reasonably predict the rate, for example, if the industry was able to influence the phasing-out speed, the companies would see it as a competitive advantage that new technologies are stimulated in this way

- Companies are now responsive to opinion from shareholders and the public and there is a broad understanding in the industry how important it is to accelerate the transition to sustainability
- The industry accepts contributions and general feedback as long as it does not distort competition or favor the importation of environmentally harmful products

3. Conclusions

The concept “emission fees” is an old-school concept that has been promoted during some decades now, but has not been further developed. The reason for why the development and adoption has not proceeded could be that other strong concepts like direct control, subsidies, emission taxes, freely allocated permits and auctioned permits have been better marketed and understood.

The advantages of this “Flexible emission fees” are many, including the avoidance of forcing established actors to re-invest in totally new technology and to scrap earlier investments. By retaining technology and infrastructure, it is postulated, and adding these control mechanisms, businesses will have time to adapt whilst retaining economic stability.

The assignment was to address the question:

> Can flexible emission fees be implemented to drive CO_2 pollution down whilst stimulating technical and economic development?

The review present research on emission policy and its implications in a climate change context. The theory is then used for evaluating a flexible fee mechanism proposed by Höglund. The review starts by introducing the reader to the project and Höglund’s flexible fee mechanism and then moves through the background of the problem with CO_2-emissions, corresponding market failure and the history of present policies. In the last chapters different solutions that might be adopted to counter this market failure and finally theoretical considerations for Höglund’s approach are discussed.

The literature review (Appendix 1) shows that the concept of a flexible fee, as innovated by Höglund, is unique. Therefore no or very limited discussion on the topic has been found in scientific journals.

The differences between a tax and a fee need to be highlighted. A sufficiently flexible and budget neutral CO_2 fee with a full rebate could be a major step towards a solution to the potential juridical and political obstacles. To evaluate this concept and it’s democratically viability should be given a high priority.

The lack of academic study of the subject (and the feedback from the workshop) tells us that the differences between a tax and a fee need to be highlighted. A sufficiently flexible and budget neutral CO2 fee, with a sufficiently large rebate, could be a major step towards a solution to the

potential juridical and political obstacles. The evaluation of this concept and its democratic viability should be given high academic priority.

The invited speakers were all positive to the concept and to trying the mechanism in a prototype or small-scale test, seeing that the mechanism could both speed up emission reductions whilst stimulating economic development. The idea that a rebate can be more effective, overall, than centralised redistribution of levied funds was questioned.

The group discussions can be summarized in a similar way: that the situation requires new thinking, that flexible mechanisms offer many benefits and could well both reduce emissions and stimulate development. The panel comments also shed light on possible barriers to implementation that need to be addressed: how to explain the system, especially how financial markets may react, and how to find a suitable implementation path. Discussions on next steps centred around finding one limited area, not yet subject to any other financial instrument, to test the theory.

The questionnaire revealed several interesting aspects around implementation. That the mechanism can work and that it will be accepted as a "green" measure. There was a need for reassurance that trade agreements will not be violated, that the mechanism could be explained sufficiently well, that it might be difficult to implement and that the business community might be against it.

Results of the questionnaire are illustrated in the enclosed figure (end of the report). In the evaluation, Disagree completely and Partly disagree is aggregated as Disagree, and Partly agree and Agree completely is aggregated as Agee.

100% support

- 5. Can reverse the trend of ecological services degradation
- 14. Will be accepted by environmental activist groups

75–99% support

- 1. Have the potential to stimulate the market to reduce emissions
- 4. Can engage market forces to focus on emissions and externalities
- 6. Represent a method to put a price on pollution
- 9. Will be popular with the general public
- 11. Will be accepted by the finance industry
- 12. Should be levied on potential pollutants at the national entry/ extraction point
- 17. Are something companies have the skill to adapt their strategy to
- 19. Can stimulate demand for clean-tech and recycling
- 20. Will cause a futures market to arise where actors hedge against

50–74% support

- 2. Can stimulate job creation
- 3. Can impact economic growth positively
- 13. Should be channelled back to all tax-paying individuals
- 16. Are something that Government agencies possess the skills required to introduce.
- 18. Are something I can imagine promoting in my own organization
- 21. Will allow companies to transition to sustainable technology without premature destruction of companies and the capital behind them

<50% support

- 7. Are easy to understand
- 8. Are easy to implement
- 10. Will be accepted by businesses
- 15. Will be accepted by the vehicle industry
- 22. Will not hinder trade between countries and continents

In conclusion, the results from the questionnaire can be summarized as follows;

- Flexible fees can engage market forces to focus on emissions and externalities (4), reverse the trend of ecological services degradation (5), represent a method to put a price on pollution (6), should be levied on potential pollutants at the national entry/extraction point (12), will be strongly supported by environmental activists (14), can stimulate demand for clean tech and recycling (19), and will cause a future market to arise where actors hedge against (20)
- Flexible fees are difficult to understand (7), will not be easy to implement (8), will not be accepted by business (10, 15) and will hinder the trade between countries and continents (22)

On reviewing the workshop and literature material, the project group concludes that there is sufficient interest to move forward with Flexible Emissions Fees, deepening academic knowledge and gaining more understanding from further discussions and prototyping.

4. Recommendations

Considering the amount of interest shown in the possibilities of applying flexible fees to reduce emissions, including that the mechanism could ensure economic stability and that the feedback revealed no major barriers to introduction, the project group recommends further investigation and research.

1. Flexible fees could be applied to both pollutants like CO_2 and essential minerals that are in danger of depletion
2. Depletion risk areas could also include other scarce and essential resources like soil, agricultural land and water
3. The group recommends that future studies address the potential of flexible fees to manage this broad range of pollutants as well as the range of substances that risk depletion Studies could focus on factors such as:
    a) Risk areas where no or limited economic instruments are in place
    b) Substances where there is Nordic technology available but is not being implemented
    c) Substances that could decrease burden on health care system if removed
    d) Possibilities to introduce flexible fee mechanisms for those substances where consumer behavior is currently driving pollution and/or depletion
    e) Areas where introduction of fees could be used to encourage investment in recycling that would increase competitiveness by lowering raw material costs
4. Much could be gained from prototyping and carrying out limited pilot studies. The group recommends therefore investigation to identify cases suitable for further study into the feasibility and efficacy of applying a flexible fee approach:
    a) A “desk-top” study from import to waste handling of one substance. This study should identify and shed light on issues of implementtation, like fee collection, market behavior, and technical adaptation as well as wider issues like stakeholder engagement, application to by-laws and other regulatory frameworks. The study could also complete a cost-benefit analysis on for example, reduction in health care costs. This would test the concept in contex
    b) Following this, a prototype study that identifies a limited area and substance. Thiswould further test the concept in application
    c) Next, a pilot study to investigate the concept in action

5. Since this study started, the Durban conference produced new binding agreements to limit greenhouse gas emissions. Since not all greenhouse gasses are covered by emissions trading the project group recommends that Nordic strategy for compliance with greenhouse gas targets be the subject of an in-depth investigation covering possibilities for flexible fees to complement current instruments. 25
6. The Höglund model proposes a return of fee income to the economy direct to each tax payer. One benefit postulated is that it creates consumer acceptance for higher prices of certain goods. This feature of the Flexible Fee Mechanism, with the potential to secure general acceptance for new and far more effective measures and solutions to the urgent problems facing humanity than previously possible could be the single most important feature of the Höglund Flexible Fee Mechanism. Therefore it is the recommendation of the project group that this feature of the Flexible Fee Mechanism be studied further as a potential driver of sustainable consumer behavior, possibly using focus groups
7. The potential for stimulating clean-tech could also be investigated. The project group recommends one or several case studies into the possibility of using fees collected to stimulate clean tech development and spread including:
   a) Research grants to universities
   b) Innovation grants to industry
   c) Grants to consumers to buy clean-tech
8. The control approach works most effectively where feedback is fast. The frequent adjustment of fees that are central to the flexible mechanism implies application of information technology. The project group believes that demand from governments for flexible fees would stimulate the IT industry to develop new applications. At the same time, the availability of applications for managing substances through flexible fees might itself stimulate demand. The group recommends therefore more investigation into the possibilities to collaborate with the IT industry to identify what kind of IT innovation is needed and what existing capabilities can be adapted
9. Several alternative approaches to further study have emerged. The project group identified the following possible next steps:

Alternative A

- Compile a short-list of what is considered to be the Nordic region's largest risks in the area of sustainable consumption when it comes to resources that are polluting and/or depleting

- Review this inventory to identify opportunities for further study that would bring the largest economic gains in terms of :
  a) Stimulating economic growth
  b) Rapidly changing consumer behavior
  c) Stimulating new technology (including IT solutions to flexible fee applications)
  d) Increasing Nordic region competitiveness
  e) Reducing health risks
- Taking one or two areas, create a desk-top prototyping to investigate further the feasibility of a flex-fee introduction

Alternative B
- Concentrate on greenhouse gas emissions to identify areas that are not covered by instruments
- Work with desk-top prototyping to investigate feasibility of a flexible approach in these areas
- Investigate the feasibility to complement existing instruments with a flexible fee mechanism in the same way

Alternative C
A study concentrates on the concept of fee redistribution including:

- Consumer attitudes to price rises
- Alternative redistribution strategies including tax reductions
- Possibilities for redistribution to stimulate clean-tech

5. Sammanfattning

Att sätta ett pris på förorenande utsläpp är fortfarande en ganska outvecklad företeelse. Det har uttryckts tvivel om dess effektivitet och oro för negativ inverkan på ekonomisk tillväxt. Utsläppen till luft och vatten ökar fortfarande och det är viktigt att praktiskt fungerande mekanismer för utsläppsreduktion utforskas och förfinas.

En mekanism med flexibla utsläppsavgifter (A Flexible Emissions Fee Mechanism) har föreslagits av Anders L. Höglund. Syftet med denna mekanism är att säkerställa att marknadens aktörer följer utsläppsmålen, samtidigt som den säkerställer att hastigheten i teknikomställningen inte störs och därigenom underminerar aktörernas ekonomiska stabilitet och hämmar den ekonomiska tillväxten. Eftersom intäkten från avgifterna kan återföras, så kan ny teknologi och hållbar produktion och konsumtion stimuleras, samtidigt som förutsättningar för fördelaktig tillväxt säkerställs.

Med den av Höglund föreslagna mekanismen, med flexibla utsläppsavgifter som utgångspunkt, bestämde Nordiska Ministerrådet att projektet skulle undersöka möjligheterna att utveckla konceptet. Huvudsyftet med projektet har varit att öka förståelsen om hur de flexibla utsläppsavgifterna kan sättas, och att besvara följande fråga: ”Kan flexibla utsläppsavgifter implementeras för att minska CO_2-utsläpp och samtidigt stimulera teknisk och ekonomisk utveckling?”

Projektet är indelat i två delar; en litteratursammanställning och en workshop, med inbjudna och erfarna deltagare.

Litteratursammanställningen visar att konceptet flexibla utsläppsavgifter, som det har beskrivits av Höglund, är unikt. Därför finns nästan ingen diskussion om ämnet i vetenskaplig litteratur. Skillnaden mellan en skatt och en avgift behöver belysas. En tillräckligt flexibel och budgetneutral CO_2-avgift med full återbetalning, kan vara ett viktigt steg mot en lösning på de potentiella juridiska och politiska hindren. Utvärderingen av detta koncept och dess demokratiska genomförbarhet bör ges hög prioritet.

Projektgruppen noterade att majoriteten av deltagarna i workshopen såg att mekanismen hade potential att vända utsläppstrenden, speciellt inom de områden som workshopen fokuserade på; CO_2 och fosfor. Det accepterades också generellt att nya mekanismer, som komplement till redan befintliga, behöver prövas eftersom situationen är akut. Detta upprepades av talarna Karl-Henrik Robèrt, Johan Rockström och Arno Rosemarin. Stefan Fölster påpekade att en centralt styrd fördelning av intäkterna från avgifterna är effektivare än en generell återbetalning

som föreslås av Höglund. Fölster var positiv till en vidareutveckling av den ”flexibla avgiftsmekanismen” och till en prototyptest inom ett område som inte omfattas av utsläppshandel.

Svaren från en enkät och gruppdiskussionerna visade att drivkrafterna inkluderar den positiva ekonomiska effekten av återbetalning av avgifterna i ekonomin, stimulans för Clean-Tech-utveckling, prissättning av förorenande utsläpp och att en terminsmarknad, för reducering av risk, kan uppstå. Hindren inkluderar svårigheten att förklara modellen och att få acceptans samt behovet av en bättre förståelse för hur handeln mellan länder ska hanteras. Inget av hindren indikerar att flexibla avgifter inte kommer att fungera. Framtida projekt bör undersöka effekten av dessa hinder och hur de kan övervinnas.

Workshopen och dess gruppdiskussioner genererade ett antal synpunkter, rekommendationer och slutsatser. Resultatet av enkäten (som fylldes i av deltagarna i workshopen) kan i korthet sammanfattas enligt följande:

- Flexibla avgifter kan; medföra att marknadskrafterna fokuseras på utsläpp och externaliteter (4), vända trenden av försämring och degradering av ekosystem (5), representera en metod att sätta pris på förorenande utsläpp (6), användas på potentiella förorenande utsläpp vid import/utvinning (12), förordas av miljöaktivister (14), stimulera efterfrågan på Clean-Tech och återvinning (19), och kan skapa en terminsmarknad där aktörerna försäkrar sig mot risk (20)
- Flexibla avgifter är svåra att förstå (7), kommer inte att vara lätta att införa (8), kommer inte att accepteras av näringslivet (10, 15), och kommer att försvåra handeln mellan länder och kontinenter (22)

Baserat på dessa slutsatser, rekommenderar projektgruppen att arbetet bör fortsätta med att presentera mekanismen och ett eller två typfall för fler intressenter i de nordiska länderna, för att samla ”feedback” som kan dokumenteras i en mer omfattande rapport, som tar upp det fortsatta arbetet med vidgade konsultationer eller implementering av småskaliga försök.

6. Appendices

Appendix 1

Fabian Levihn. 2009. Flexible fees as a driver for countering externality problems. A review of present research. The Royal Institute of Technology, KTH. Industrial Engineering and Management. Department of Industrial Economics and Management.

Appendix 2

Stephen Hinton and Anders L Höglund. 2011. White Paper. How flexible emission fees can drive transition to fossil-free and sustainable living. The Swedish Sustainable Economy Foundation.

Appendix 3

Anders L Höglund. 2010. A new method to reduce the emissions of greenhouse gases. The Swedish Sustainable Economy Foundation.

Appendix 4

Anders L Höglund. 2011. Flexible Control Fees with Repayment.

Appendix 5

Anders L Höglund. 2011. Beneficial Effects from Flexible Control Fees.

Appendix 6

Results of Questionnaire (22 questions from Workshop).

7. Appendix 1

7.1 Flexible fees as a driver for countering externality problems

A Review of present research

Author: *Fabian Levihn*. Royal Institute of Technology (KTH). Department of Industrial Economics and Management.

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7.2 Executive summary

7.2.1 Introduction to the report

Greenhouse emissions are externalities of business activity, most likely accelerating climate change. If business as usual continues we can expect atmospheric carbon dioxide concentrations to increase to levels that threaten climate stability. To reach safe levels a rapid reduction in emissions is needed.

Many policies have been implemented to date to address this market failure.[1] Approaches include limiting emissions directly, affecting demand or stimulating technological change. What we do know is that marginal abatement cost (MAC) varies between different areas and that positive discount rates call for investments where MAC is lowest first. It also tells us that policies will need to be adjusted and become firmer in the future as MAC increases.

This report reviews present research on emission policy and its implications in a climate change context. The theory is then used for evaluating a flexible fee mechanism proposed by Anders Höglund. The Report starts by introducing the reader to the project and Höglund's flexible fee mechanism and then moves through the background of the problem with CO_2-emissions, corresponding market failure and the history of present policies. In the last chapters different solutions that might be adopted to counter this market failure and finally theoretical considerations for Höglund's approach is discussed.

The subject of market failure is important to further define. In this report market failure equals when costs of external effects due to production and consumption is not reflected in market price. It is thus not implementing that the actors on the market have failed, rather a system where all effects are not included.

The literature review shows that the concept of a flexible fee as used by Anders Höglund is unique. Therefore no discussion on the topic has been found in scientific journals.

Many results from modeling and other experiments are included in this review. Mainly because of space deeper descriptions of these experiments are left out. The reader is advised to follow references for deeper knowledge.

7.2.2 Efficient policy

When implementing new policies there should optimally be one policy set per goal. Policy is most efficient if directed directly at the source for achieving this goal. If one policy is directed at actual emissions, another is needed to stimulate a goal of technological development. In this way, one policy puts new products on the shelf while another creates a demand for taking them off the shelf and into a market. If there are parallel policies with the same goal, efficiency is gained when policy outcome is harmonized.

Corporations today are generally positive to the introduction of climate policy but are dissatisfied with present systems. These are seen as

[1] It might be valuable for the reader to understand that market failure implies that a cost is not reflected in market price, such as the case with global warming and CO_2 emissions. Market Failure as used in this report is further explained and defined in section 5.1 page 14.

ineffective, inconsistent and unclear. Especially sending long term signals is asked for to provide incentives for investments in R&D. Corporations call for hypothecation of taxes as well, together with a demand that abatement burdens should be shared by international competitors.

The arguments for why a certain policy should be implemented or not are listed in table 1 below.

Table 1. Arguments for and against different policies

POLICY	FOR	AGAINST
Direct controls	Efficient if a total ban is called for or MAC at level between different abatement options.	Economically ineffective as MAC differs between options in a climate context. Technological standards do not affect demand for emitting carbon directly.
Subsidies	Do not increase costs for corporations. Possible to use alongside other policy to support ITC. Little resistance from industrial lobbyist expected. Possibility for increased efficiency. Preferable if incentives for R&D from other policy are not enough.	Do not affect price on present carbon based good. PPP not followed. If substitutes are not good enough no incentives for using them exists. Incentives for new actors to enter a market might increase overall emissions.
Emissions Taxes	Supports PPP and raises capital for supporting abatement or other causes. Direct price on CO_2-emissions affect demand negatively. Efficient policy compared to others as uncertainty regarding climate change related topics exists. Efficient as MAC directs who will perform abatement or not. Fair if predictable and equal incentives for abatement are introduced. Raises capital. Culturally traditionally preferred over other systems in Europe. Preferred by corporate executives. If possible to implement transfer mechanisms, overall tax burden might be preserved or desired distribution of resources obtained.	Lack of flexibility and incentives. EU wide tax hard to implement as all member states must support it. Hypothecation and earmarking preferred by researchers and corporations, but not possible to implement in all regions (amongst those EU). Industry lobbying against increased costs expected. A global CO_2 tax needs to handle distributional effects. Harmonized national taxes hard to make flexible and adjustable enough. Hard to estimate impact. Tax levels often based on trial and error. Verifying emissions problematic in many sectors.
Flexible fee *(compared to a regular emission fee/tax)*	Futures trading provide price discovery function. CO_2 taxes already exist in many countries. System possible to implement alongside present taxes. Present tax infrastructure possible to use. Risk transference and possibility to reduce cash flow CO_2 related risks. Upstart parallel to existing systems possible.	Price discovery function might be biased thus leading to inefficient decisions. Introduced uncertainty lowers incentives for long term investments. Harmonization with other systems counteracted. Unclear if present political systems support frequent adjustment of environmental fees due to political and juridical processes.
Freely allocated permits	ARP a success and cost efficient. Efficiency as capital is distributed to low MAC investments. Important when abatement costs varies. In control of total emissions. "Fair" as abatement is decentralized. Industry liquidity preserved as no money leaves affected system. Les resistance from industry lobbyist expected compared to when direct costs are introduced. Easier to implement compared to taxes in EU. Accepted by those participating in a present system.	EU ETS has shown high volatility thus increasing CO_2 related risk lowering investment incentives. Not enough incentives for abatement, costly, short term perspective and geographical limitations during EU ETS. Lack of certainty and simplicity. Do not support PPP. Emissions not traded remains invisible thus reducing learning and clarification. Might not generate capital needed to perform abatement. Verifying emissions problematic in many sectors. EU ETS seen as complex and bureaucratic.. Resistance from industry expected as costs are introduced.
Auctioned Permits *(compared to freely allocated permits)*	Distributional effects, marginal impact on competition, higher economic efficiency, more clear incentives and higher price stability when compared to freely allocated permits. PPP followed.	

7.2.3 A flexible CO_2 fee as proposed by Höglund

Adjusting fees at regular intervals could provide a pollution abatement price discovery function, not least by stimulating futures trading. If the predictions are unbiased, this could improve present policy adjustments. Any uncertainty around future fee levels however, could act negatively on incentives for long term investments and R&D. According to Anders Höglund a political commitment to introduce a fee on the import and/or extraction of all fossil carbon, combined with a repayment of an equal fraction of the fee revenue to every individual, could eliminate the uncertainty, especially if the system includes a political commitment to adjust and increase the fee regularly according to the best available information.

Costs for implementing the proposed policy could be kept low by using parts of the present tax system. Still, there is uncertainty regarding if present political and juridical systems would allow for sufficiently frequent and rapid adjustments. In particular if a fee would be regarded as a tax indifferent of name from a juridical and political perspective. This is an area that should be the focus of future research.

7.2.4 Implications on present research

During the process of this study it came clear that both corporations and researchers lack understanding of how political and juridical obstacles affect policy making and the possibilities to implement them. Even though many of the reports included in this study give advice for policymaking, only a few discuss obstacles.

The political framework in Europe makes a harmonized tax hard to implement as all member states must support it. The framework also counteracts earmarking of capital raised by taxes. This affects the possibility to design and implement many policies. In the same way, juridical and political process counteracts frequent adjustment of a tax. This would also be the case for an environmental fee. Even if it is not a traditional tax the corresponding juridical and political framework differs within EU, its member states and other nations.

The differences between a tax and a fee need to be highlighted. A sufficiently flexible and budget neutral CO_2 fee with a full rebate could be a major step towards a solution to the potential juridical and political obstacles. To evaluate this concept and it's democratically viability should be given a high priority.

Mapping these obstacles would therefore be a valuable addition to present research and would provide a basis for the discussion of how and which policies should be included in mathematical and economic modeling. Today, corporate lobbying and resistance is often included in analysis and discussion of policy instruments, but the political dimension is

left out. An increased understanding and mapping of this dimension would add an important perspective.

Many researchers as well as corporations argue that international competition calls for harmonized or international emissions policies. The theory of border adjustments to decrease regional influences on competition could though be analyzed and modeled more thoroughly. Also the influence of international trade agreements needs to be added to the discussion.

7.3 Project description

This chapter which gives the reader an introduction towards the project is written by *Magnus Enell*, project owner.

7.3.1 Background according to the proposal

It is widely accepted that putting a price on pollution is one way to curb it. However, the practice is still rather undeveloped and doubts have been raised about.

- Its effectiveness
- Negative impacts on economic growth.

It is therefore vital that practical mechanisms continue to be explored and the techniques refined.

Flexible pollution fee mechanisms have been proposed by, among others Anders Höglund, the Swedish Sustainable Economy Foundation, a research evaluation of Höglund's approach was done in 2005 by IVL Svenska Miljöinstitutet (Sanctuary 2005).

Höglund had developed a control technology that, with the help of advanced electronic control of the combustion cycle, ensured almost zero emissions of pollutants from engine designs that previously produced high levels of emissions[2]. This is an example of control engineering, the engineering discipline that focuses on the modeling of a diverse range of dynamic systems (e.g. mechanical systems) and the design of controllers that will cause these systems to behave in the desired manner.

Höglund postulated that a feedback control approach could be applied to macro economics (specifically, to economic policy), applying control approaches to supply and value chains containing pollutants. More specifically, a variable fee could be levied dependent on the behav-

[2] The pollutants reduced by engine control systems include soot particles and NO_x. Carbon Dioxide is affected indirectly as more efficient burning means less fuel used per km.

ior of these supply and value chains and the markets, including the financial markets, that influence them. He postulates that sufficient application of these mechanisms – simply put if the fees are high enough – ensures market actors comply with national emissions targets set by governments.

This approach stimulates the market to stay within boundaries whilst ensuring the rate of change does not undermine actors' economic stability, which would stunt economic growth. On the contrary, the income from the fees levied could be channeled back to stimulate new technology, sustainable production and consumption. This represents one of the promises of clean-tech: to take existing, dirty, technology add an advanced control layer, feedback mechanisms and possibly end-of pipe cleaning system, to achieve better efficiency and less emissions.

The advantages of this approach are many, including the avoidance of forcing established actors to re-invest in totally new technology and to scrap earlier investments. By retaining technology and infrastructure, it is postulated, and adding these control mechanisms, businesses will have time to adapt whilst retaining economic stability.

At the same time, the emissions fees should be high enough to change supply chain behavior and consumer behavior, leading to sustainable production and consumption.

One important aspect of this clean-tech through control approach is the creation of instable processes. (Rather like the instability of modern fly-by wire fighter aircraft.) Applied to the economy, the approach would mean creating a mechanism whereby emissions fees are flexible, and to a certain extent, unpredictable, rather like interest rates. In practice, the approach calls for an emission monitoring mechanism to be set up, and a system to charge and change fees on a regular basis. The level of fee will be set according to how well emission reductions correspond to targets. If they are above targets, the fee is raised. If they are below, the fee remains unchanged or is lowered. (Below target emissions are still externalities that burden the general population and should still be taxed to compensate.)

Revenue from this system can be used to stimulate the development and spread of technologies and equipment that emits less. The uncertainty generated by the flexibility of the fees would stimulate the development of futures markets and attract the scrutiny of the financial community that invested in them. This is an important area of study for sustainable economics, and mechanisms to address externalization of costs.

The IVL report concludes that the approach is promising, but points out that more work needs to be done to understand; "Under what type of scenarios would Höglund's fee be most effective in terms of efficiency and distribution?"

Specifically, past investigations have concentrated on economic analyses and simulations. How people and markets react in reality can differ. Some examples of unanswered questions include: WILL companies invest in clean technology if high emissions fees threaten? WILL the fees

get diverted to stimulate new investment? WILL the flexibility of the fees be easy enough for government departments to run? CAN economics be applied to stimulate sustainable consumption and production?

Initial feedback from administrations and industry is positive. Investigating flexible fees further would give the Nordic Region unique insights into the potential of using fees to meet emissions targets, their drivers and barriers. Especially the production of a specific case story that has elicited the viewpoints of all actors involved is interesting. The Nordic region could influence development and spread of these fees globally.

The workshop and follow-up review will shed light on the opportunities for the Nordic region to introduce the mechanism in selected areas and both lead the world in emissions reductions and the development of clean tech stimulated by economic mechanisms.

7.3.2 Goal and limitations according to the proposal

The main goal of the project is to increase understanding of flexible emission fee setting and answer the following question:

- Can flexible emission fees be implemented to drive CO_2 pollution down whilst stimulating technical and economic development?

The workshop will present a simplified case illustrating the application of flexible emissions fees to drive sustainable consumption and production.

By working through the case and giving feedback the workshop effectively maps the perception of the wide range of stakeholders involved as to the benefits, drivers and barriers to its introduction. It also prepares the way for a gathering of data, perspectives and possibilities on a Nordic level as well as a small scale test.

If flexible fees are a way forward, this workshop will prepare the ground. If barriers are perceived as too high, or efficacy too low, these results will inform further studies and opinion.

Representatives of the following sectors will be invited:

- Government Authorities
- Trade and Industry
- Environmental NGOs
- Academia
- Financial industry

The case presentation will answer the following questions, which, together with the attitude investigations below, will form the basis of the research questions addressed by University researchers:

- What is new and innovative about flexible fees?
- How the market decides the level of fees
- How the mechanism would work with existing steering mechanisms
- Why a redistribution of fee revenue is necessary
- How the capital markets would be stimulated and react
- How options trading would arise

Sectors' attitude to the following will be gathered, along with proposals

- Benefits each sector sees of introducing flexible carbon emission fees
- The effect on development of technical infrastructure and stimulation of clean-tech
- Possibilities for fee collection
- Effects on national, individual and company economy
- Potential issues each sector sees with the introduction, including political barriers
- Effort required for introduction
- Potential business, technical, fiscal, and opinion risks of introduction
- Likely effects on emissions and the rate of reduction of emissions
- Likely effects on economic growth
- How to garner opinion for introduction

7.3.3 Target groups according to the proposal

The results of the study are likely to be highly interesting to industry representatives, governmental agencies responsible for control of emissions, regional and local authorities, the financial markets, political parties and non-governmental organizations (NGOs). The kind of interest shown is using such fees will be valuable input for clean-tech inventors and entrepreneurs.

7.3.4 Activities and time plan according to the proposal

The project can be divided into three phases, which all can be standing alone;

Phase 1. Literature review and a workshop, resulting in a report describing "Flexible emissions fees and transfer mechanisms as a driver of pollution reduction, and development of sustainable production and consumption".

Time period; May 2010 – January 2011.

Phase 1 consists of the investigation (literature review) and a full-day workshop with representatives from various stakeholders that have interest in finalizing the case study/literature review that exemplifies the mechanisms of flexible emission fees for CO2 emissions, and to compare with other approaches. Based on the feedback from the workshop,

a full report will be published and distributed to all stakeholders. The theme of the workshop will be;

- How would the mechanisms work?
- What would be the drivers and barriers from your perspective?

*Phase 2***.** Five cases, one for each of the Nordic countries.

Time period: March 2011 – March 2012.

Phase 2 will focus on the case being studied in the five Nordic countries, and by involving more stakeholders.

Phase 3. The five cases are put together to the Nordic case.

Time period: April 2012-January 2013.

Phase 3 is where the five Nordic cases, with findings and recommendations, are put before a wide Nordic audience for feedback and comment.

7.4 Flexible fees as a driver for countering externality problems

This chapter, written by *Anders Höglund*, the "inventor" of the concept that is the basis for this project, introduces readers to the initial idea behind flexible fees. The idea was formed already in 1989, but was not actively further developed until 2008–2009.

The concept that environmental problems facing humanity can be solved by informing and educating people to change their lifestyle and take a personal (economic) responsibility for global problems may be based on good intentions. However, this concept is not only ineffective but also counterproductive since it has unfortunately shifted the focus from, and delayed, the elimination of life-threatening systemic errors.

The failure to effectively internalize harmful externalities in the economic system, pervading almost all aspects of human life, has resulted in an unsustainable lifestyle and a potentially lethal conflict of interests both locally and globally.

One way of solving this problem and to simultaneously eliminate a major systemic error is to create an incentive structure, in the economic system, which is beneficial for stable, sustainable development.

One way of creating such an incentive structure, making development and growth environmentally compliant, genuinely sustainable and to an increasing extent immaterial, is to charge fees on the use and depletion of natural resources, including the emissions of environmental pollutants. If these fees are sufficiently high the probability of the peaceful survival and development of mankind in a very long-term perspective can be maximized.

By utilizing a futures market to set the level of the fees, an "emissions reduction cost driven" feedback system can be created as an integral part of a market economy. This is, in other words; one way of making the market self-conscious, reflecting and internalizing – qualities which hitherto have been missing. See; Hoglund, A (2010), "A New Method of Reducing the Emissions of Greenhouse Gases", The Swedish Sustainable Economy Foundation.

During a trial period, before allowing the "feedback market" to become fully autonomous, the fees can be set by political decree. The only political requirement for a fee futures market to emerge spontaneously is that the fees are adjusted sufficiently frequently.

A high or even increased rate of consumption and employment does not have to be tantamount to a high or increased rate of depletion of natural resources and increased environmental damage. On the contrary, even an increased rate of consumption can, with properly applied economic control fees, be made long-term sustainable and be guided towards goods and services reducing its harmful impact on the natural capital.

It has been claimed that a CO_2-fee, which is sufficiently high to effectively begin to abate the emissions of CO_2, will be harmful and incur a high cost, due to a reduced economic growth. The truth is that every tax or fee in the economy is also a revenue in the economy and what determines the real economic result is how the redistributed money is used.

It is common, in model calculations of the effects of emission fees on the growth of GNP, to ignore the fact that the GNP figure does not only include produced benign goods and services but also, to a large fraction, products and activities that are both unwanted and/or directly harmful. Therefore it is a mistake to believe that maximum GNP growth is the most important criterion when ranking different development alternatives.

To make a high CO_2-fee (or any other fee) acceptable to the majority of the population a repayment of a sufficiently large fraction of the total fee is advisable, for example, through a reimbursement mechanism with individual reimbursement accounts. By utilizing such a reimbursement mechanism wisely the control fees can always be made to have a neutral, or if so desired; positive, impact on the budget.

A repayment on these terms can be made profitable for the majority of the population directly and for the whole economy indirectly and will result in an employment promoting redistribution of economic resources and purchasing power. This will reward new markets with a growing benign demand resulting in a sustainable, global development. A failure to promptly apply the measures proposed above may result in dangerous energy and resource crises in the future with civil unrest, collapsing labor productivity and mass starvation with scary consequences.

In conclusion; global economic growth and development can be made benign and sustainable by a proper use of economic feedback controls. The economic feedback control proposed here can be designed to bene-

fit the majority of the population in addition to being efficient, objective and fair in treating all emissions and emitters the same.

Reducing the CO_2-emissions from new cars, by imposing a maximum allowed level of CO2-emissions measured in grams/km, is not a good idea. In reality it is a textbook example of bad economics due to the fact that the real cost of reducing those CO_2-emissions is many times higher than achieving exactly the same emissions reduction by treating all CO_2-emissions the same by using one single CO_2-fee.

This type of inefficient and wasteful legislation could be the dismal result if short-sighted political considerations are being given a higher priority than efficient solutions to environmental problems. Without a veil of disinformation and ignorance this kind of political maneuvering would not be accepted by the voters. Fortunately, this conflict of interests is unnecessary since there are efficient and more economical solutions that are genuinely profitable for the majority of the population and the voters.

The European Emissions Trading Scheme for reducing the emissions of CO_2 is suffering drawbacks too. One of these is the fact that the system does not include all CO_2-emissions. In addition; granting emission permits for free and letting the recipients determine their own expected future levels of emissions and need of permits has delayed the total emissions reduction process. The transaction costs in the ETS are also considerably higher than in a much simpler and more effective system charging a straightforward (upstream) fee on the carbon content of all imported and/or extracted fossil fuels.

In a long term perspective sufficiently high taxes and fees on activities, which are harmful for the long term survival of mankind, will make it possible to successively abolish taxes and fees on other activities, which are beneficial for the long term survival of mankind.

More explicitly; in the future, taxes on financial capital, real capital and human capital, including labor, could be abolished. Such a tax reform would generate a positive "economic quantum leap" since the sustainable purchasing power, which creates a demand for long term sustainable and environmentally compatible products and services, under these conditions can reach its full potential which in turn can positively affect the economic conditions for research, investment, production, employment and genuinely sustainable growth.

Since the individual and automatic payment of sufficiently high fees, which will be an integral part of the price of all goods and services in the future, is directly proportional to the actual use and depletion of natural resources, including the amount of harmful emissions, that each individual is causing directly or indirectly, the payment can be interpreted as an individual and personal economic responsibility-taking for the natural resources which every individual is using, spending and consuming.

7.5 The global challenge

- The world population is growing at 1% per year and is expected to reach 8.2 billion in year 2030[3]
- Adjusted GDP is expected to increase 3.1% per year in average during the period of year 2007–2030, mostly in the developing world[4]
- 1% increase in GDP leads to a 0.7% increase in energy demand. As such energy demand will rise with over 2% per year in average during year 2007–2030[5]
- As most energy sources is based on fossil fuels or other GHG emitting sources a decoupling of this dependency is needed if climate goals are to be met[6]
- 30% of this change is needed to come from non existing technologies, the rate of change higher than during the industrial revolution [7]
- Due to increasing marginal abatement costs (MAC) the 1st lowered emission of GHG's is much cheaper than the 99th. It is also cheaper to lower GHG emissions within some areas than others[8]
- CO_2 is believed to be most significant of the GHG's[9]

7.6 Background

7.6.1 Market failure

Market failure is a term that refers to conditions where markets do not produce optimal welfare. In an environmental context this is often based on the presence of externalities, nonmarket side effects of the production or consumption of a good. This is often the case when it exist no ownership of a resource (common property resources – CPR). [10]

If water is free in an area but there is shortage of water an externality problem arises when someone uses water, also an example of a market failure. The thought is that a price could be introduced to correct the market failure and make the resource, in this case water, be used in the most efficient way. The same accounts for climate change and CO_2 emissions. More emissions make the assimilative capacity of the atmosphere for CO_2 without altering earth's climate scarcer.

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[3] IEA 2009.
[4] IEA 2009.
[5] IEA 2009.
[6] Stern 2006.
[7] Discused in McKinsey&Company 2008.
[8] Stern 2006.
[9] IPCC 2007.
[10] Market failure, externalities and CPR discussed in Sterner 2003.

Policies are tools for governments or other authorities to counter market failures, even if the existence of a market failure is not explicitly discussed during the implementation of a policy.[11]

Economic growth influences demand for emitting carbon. Failure of the market mechanism to regulate emissions potentially causes climate damage. Therefore, putting a price on carbon emissions may correct for the market failure by driving alternative technologies. An incremental change in solar power technology might have a marginal impact if the price on CO_2 is low and a larger impact if the price is high. Efficiency gains in present fossil fuel based technologies might in the same way be taken up during low prices than a high, especially if the price is high enough for society to shift away from fossils altogether.[12]

As shown by McKinsey there will be a need for technological development to reach climate goals.[13] Here different policy will need to act differently. While some policies correct the market failure and put a demand for technologies from the shelf, other policies are needed to stimulate R&D and put new technologies on the shelf. Especially, as some technologies need longer time for development, investments must be motivated by future market conditions rather than present.[14] Not the least carbon price risk regarding energy related investments.[15]

Thus stabilizing greenhouse gases efficiently requires both technological development and correction for the market failure. Many policy options will increase the price for different CO_2 emission based products, thus leading to lower consumption and a lower GDP that falls short of its potential.[16]

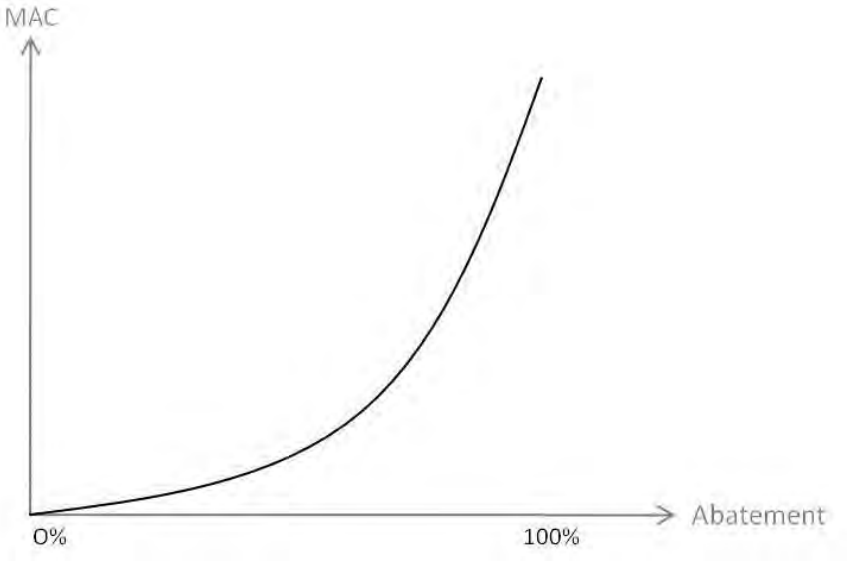
7.6.2 Marginal Abatement Cost

Efficiency is gained by performing the cheapest abatement today as we expect average increase in GDP in the future and therefore have positive discount rates for future abatement and related expenditures. Low cost solutions and efficiency gains are realized at first. Later substitution of present infrastructure and technology is more expensive. The marginal abatement cost (MAC) increases the higher the level of CO_2 reduction.[17] To pro-

[11] For Swedish readers (and perhaps others) a clarification the concept policy might be called for. Policy is in this report used to describe a course of action or principle adopted or proposed by a government. Thus policy includes actions such as taxes, laws, regulations, etc.
[12] Price influence on market failures discussed in Baker et al 2008.
[13] McKinsey&Company 2008.
[14] Richels & Blanford 2008.
[15] Blyth et al 2009.
[16] Content of section discussed in Richels & Blanford 2008.
[17] Efficiency of abatement discussed in Blyth et al 2009.

vide incentives to correct the market failure and perform a shift, the corresponding price for abatement follows an upward trend (se figure 1).[18]

Figure 1: The relationship between MAC and percentage of abatement.[19]



If climate goals are continued to be pursued, we will thus expect a higher price on CO_2 in the future to provide enough incentives as MAC increases. Policies will need to be adjusted to follow this development.[20]

7.6.3 ARP – US Acid Rain Program

Many different policy instruments exist; all have different pros and cons. Some use more direct control while other alters prices through taxes, subsidies or fees. Some policy instruments also try to utilize market mechanisms for achieving efficiency. Different mechanisms are discussed later in this paper.

One of the first widespread attempts at lowering emissions through a market based policy mechanism was the US Acid Rain Program (ARP) under the Clean Air Act Amendments (CAAA) introduced in year 1990. The program was designed to reduce acid rain through the introduction of permits to emit SO_2 from electric generating plants to half of their year 1980 levels. The goal was a reduction of 5.7 million tons per year

[18] Rive 2009.
[19] Further discussed in Baker et al 2008.
[20] Stern 2006.

from the start in year 1995. During predetermined phases the program tightened to make firmer pressure on the industry to adopt.[21]

The program was in many ways a success and the cut performed more efficiently than first anticipated with a cost of $ 1 billion, $ 9 billion lower than first claimed by industry lobbyists. This is believed to be half the cost if a non market based policy would have been adopted.[22]

7.6.4 EU ETS

The biggest attempt on a market based policy is the European Union Emission Trading Scheme (EU ETS) that was introduced in accordance with the implementation of the Kyoto Protocol in Europe. The program covers almost half of the EUs CO_2 emissions from 12'000 installations in 25 countries. As with ARP the ETS was designed to be implemented over several phases. [23]

During the first phase from year 2005–2007 the European emission allowances (EUA) were grandfathered freely to included sectors according to the wish of individual member states as long as they were under the national cap (based on Kyoto goals).

Corporations under the EU ETS are also allowed to perform banking with allocated allowances. Thus "emit now counting on emitting later" or "save allowances for the future". Actors on the market might also chose to trade emission allowances, or meet their targets buy buying Certified Emission Reductions through the Kyoto based flexible Joint Implementation (JI) or Clean Development Mechanism (CDM).

Tradable emission permits were not the first choice as many member countries supported and strove for implementation of a harmonized CO_2 tax for the European Union. One of the main reasons EU ended up with a cap and trade system was the basic design of the political system. To impose a union wide tax unanimity has to be reached. In other words all member states must support it and any single one of them has the ability to stop it. Tradable permits such as ETS counts on the other hand as an environmental mechanism and thus a qualified majority was enough to enforce it.[24]

The EU ETS allowance market has shown extreme volatility. During year 2006 the price ranged from $ 44.47 up to $ 143.06 per ton emitted CO_2. When new regulatory information was introduced prices fell by 70% during one month (se figure 2). Amongst others that banking be-

[21] History of ARP reviewed in Chesney & Taschini 2008.
[22] MacKenzie 2009.
[23] History of EU ETS reviewed in Chesney & Taschini 2008.
[24] Implementation of EU ETS discussed in MacKenzie 2009.

tween phase one and two would not be allowed.[25] Lax caps could not ensure a carbon price at all which was seen during the collapse and no incentives for abatement existed under such scenario.[26] During the first phase of ETS free allocation also made competitiveness effects less imminent. A strengthening of the scheme would have continued limited effects according to simulations.[27]

Figure 2. EU ETS historic price development.[28]

Economic instruments that move risks associated with fluctuations in the CO_2 market from those who accept it to those who wants a safe position, are important to provide incentives for long term investments and corporate commitments. Such markets have a tremendous growth potential leading to increased trading in emission rights and therefore also adds market liquidity (due to the presence of speculators).[29] Futures contracts that guarantees the delivery of EUAs to a fixed price on a certain day is traded on many listings across Europe. Amongst these Nordpol, European Climate Exchange (ECX), European Energy Exchange (EEX) and Blue Next.

There is critique directed towards EU ETS and the Kyoto framework from an environmental point of view to not provide enough incentives to bring more than incremental change to GHG emission trajectories, while

[25] Nordhaus 2007.
[26] Alberola et al 2008.
[27] Wobst (edt) 2007.
[28] Curves created with EUA Historical transactions data since 2005-06-24 made available from the Blue Next exchange.
[29] Paolella & Taschini 2008.

being costly to administrate and implement. Also there is in the case of Kyoto Framework no plans made for how development should be made post year 2012 thus bringing inefficiency as corporations have hard to make long term commitments during such a short timeline. Geographical limitations also exist as China and US refused to sign the protocol along with large part of the developing countries. This makes the influence of the protocol limited and risk of carbon leakage imminent.[30]

7.6.5 European CO_2 tax

More than a decade before introduction of the EU ETS many European countries introduced a tax on CO_2 emissions. During the late 1980s and 1990s energy prices where low and thus incentives for energy efficiency also low. At the same time beliefs was in market liberalism and that governments only should intervene to correct market failures. The rest the market would fix by itself.[31]

A European hybrid energy/CO_2 tax was proposed during year 1992 (EU COM (92) 126 1992), but was never introduced as resistance was large from industry and some member states. Especially UK worked against it. Even though the proposal was failure and a union wide tax never was implemented, some countries introduced a tax by themselves. Finland was first in year 1990 followed by Sweden and Norway in year 1991 and then Denmark in year 1992. The Netherlands had though already in 1988 introduced a tax on hydrocarbon based fuels that was extended to CO2 in year 1990 and energy in year 1996. The design of the tax among the Nordic countries made consumers take the burden as most large emitters where exempt because of international competition.[32]

In Sweden and many other EU member states, a CO_2 tax today works alongside the EU ETS for the non trading sector to provide abatement incentives. At present, Sweden has the highest CO_2 tax in the world and this has not caused havoc to the Swedish industry or trade balance. There are also suggestions for increasing the Swedish CO_2 tax to harmonize it with EU ETS levels.[33]

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[30] Content of section discussed in Nordhaus 2007.

[31] Nilsson et al 2009.

[32] History of European CO_2 tax incentives reviewed in Smulders & Vollebergh 2001.

[33] Broberg et al 2008.

7.7 Corporate view on present climate policies

A report by PricewaterhouseCoopers (PWC) released during year 2010 examines through interviews with 700 executives from 15 countries attitudes amongst the international business community towards different environmental policies (all statements in the following sections are from the PWC report making separate references are redundant).[34]

Results from this study show that 80% believe that regulation and tax incentives motivate businesses to change their environmental behavior. Tax charges are considered effective by 74% of business leaders and 95% agrees that tax and regulation will help the world to reach a climate deal. 59% believes trading schemes are effective, regulation 83% and voluntary agreements 45%. As much as 71% believes that existing incentives does not change environmental behavior.

Still businesses want to be assured that the burden of abatement is shared by international competitors and expresses that long time planning is essential for the transition towards a low carbon economy. Especially as the development of new technologies is costly and needs large capital expenditures. When overlooking long-term investment strategies corporate leaders must forecast likely carbon policies and their outcomes five to ten years in the future.

64% of all participating corporations support the idea of a carbon tax. But it can be seen that those participating in a system generally support it more than those that do not. An example is participants in a trading scheme where 82% supports it. Still, existing environmental taxes, regulations and incentives are seen as ineffective, inconsistent and unclear. Clearing this uncertainty and sending long-term signals is seen as critical for the transition to a low carbon economy by 96%.

For carbon trading the greatest challenge is to create certainty and simplicity. For carbon taxes the key issue is flexibility and incentives. The volatility of the carbon price and the bureaucracy surrounding European Union Emission Trading Scheme (EU ETS) have led many European executives to conclude that a carbon tax would be easier to administrate and provide more stable criteria for strategic decisions. Thus more European corporations believe a carbon tax would be better for their business (especially in France, Sweden, Germany, Russia, Australia and the UK).

Business leaders want carbon taxes to fund low carbon programs e.g. hypothecation (or reserved). They also see that environmental taxes offset other taxes so that the total tax burden facing the firm is not increased.

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[34] PWC 2010.

To summarize:

- Corporations are dissatisfied with present emission policies
- Emission taxes are seen as simple and effective policy tools
- More corporations support emission taxes than trading schemes,
- But those already participating in a trading scheme are in favor
- Especially if the taxes are flexible and subject to hypothecation, or the total tax burden facing a firm is unchanged, corporations are in favor of environmental taxes
- Policies must support long term planning
- Burden for abatement shared by (international) competitors

7.8 Choosing Policy

Many potential policy instruments exist to correct for market failures and be applied in a climate change context. Either through providing direct incentives for abatement through command and control, or through economic instruments designed to correct the market price for emitting GHGs. One important target while designing a climate/CO_2 – policy is to achieve targeted abatement at the lowest possible cost for society.[35]

Economic instruments are by some seen as more useful when the response to a policy varies between different affected firms and necessary information for perfect regulation is abundant. The climate change issue is a perfect example of this and different sectors and enterprises can reduce CO_2 emissions more cheaply than others. Command and control are more preferable when there is good access to information and best effect is achieved by introducing similar requirements upon firms. If the optimal (economic and environmental) level of a pollutant is zero a ban is the most effective way to reduce it.[36]

Policy should always be designed to be directed explicit on a certain goal. CO_2-taxes and trade systems are examples of policy instruments targeting directly at emissions where as subsidies and other policy such as promoting railway development are more indirect and therefore more expansive if the target is to decrease CO_2 emissions. In the same way policy should be directed on emissions related to certain production process rather than on production itself. In this way incentives for corporations to invest in alternative ways to produce are present rather than incentives to lower overall production. Also there must be one poli-

[35] Broberg et al 2008.
[36] Content of section discussed in Hepburn 2006.

cy per goal, so a flora of goals needs a corresponding flora of policies to be implemented.[37]

Parallel policies must work together and induce price harmonization to gain economic efficiency. In Sweden, with its parallel systems of tax and tradable permits, economic efficiency is achieved if the tax and permit prices are at level. Another way is to expand one instrument (probably the EU ETS) to make policy harmonized over more sectors. Many believe effective carbon policy counters market imperfection by putting a price on CO_2 wherever abatement is performed, who performs it or how. Harmonization of the carbon price between different sectors is also more economically efficient than having differentiated prices.[38]

The optimal level of emission reduction is a difficult and controversial question.[39] Still political factors are often influencing policy formation more than economic consideration.[40] Even though it at first might seem illogical, maximum abatement is not the preferable choice. Resources (economical and other) are finite. Thus total abatement under one cause might take more resources from other environmental areas, education, healthcare etc than is saved. In other words the policy would lead to national dividend and welfare falling short of potential.[41]

Some policies will have side effects by providing incentives for technological change (see section on ITC) and other co-benefits. One example is CO_2 policies which offer air quality benefits and thus costs can be shared between multiple goals. These benefits are lost from the own economy if CO_2 is reduced through offsetting systems like obtaining certified emission rights (CER) through the CDM mechanism.[42]

According to the Porter Hypothesis environmental regulation will lead to efficiency gains in industry, thus policy pays for itself. Innovation brings side-benefits besides lowering emissions or pollution and new technologies get introduced.[43] Although this might be true for some possible developments, for other the MAC is higher thus resulting in lowered GDP as production costs are increased.[44] [45]

Optimally, policy will change as new information gets available regarding climate science, corporate response and as technological development and innovation changes market conditions. Also uncertain future political reasons and public opinion might promote a shift in policy and adds uncertainty regarding policies. This affects long term invest-

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[37] Content of section discussed in Broberg et al 2008.
[38] Content of section discussed in Broberg et al 2008.
[39] Nordhaus 2007.
[40] Hepburn 2006.
[41] Sterner 2003.
[42] Rive 2009.
[43] Porter 1990.
[44] Richels & Blanford 2008.
[45] Broberg et al 2008.

ments, commitments and R&D efforts from the industry. Policy needs to take into consideration these aspects and be designed to be flexible enough to respond to changed conditions at the same time as they must have long term commitment to provide incentives for corporations to perform abatement-related long term investments.[46]

The presence of global markets leads to a risk of carbon leakage as products from areas not affected by climate policy might be more price-competitive. To prevent carbon leakage one way is to harmonize policy over multiple regions independent of which policy instruments are present, and another to provide border adjustments for carbon prices. The later is done by making it possible for corporations to deduct the carbon price on exported goods and add it on imported to regions under the policy. [47]

Quantity based

One of the most used policy instruments are command and control where quotas, targets or bans are introduced. Many environmental policies set a maximum ceiling for certain emissions. The introduction of a market for trading allowances for performing a task is also one way to add market incentives to an overall goal or quota.

Price based

Price based instruments use the effect of how a change in price affects demand. Cameron Hepburn illustrates this with two examples:[48]

- Instead of setting a total amount of cigarettes to be consumed a country might put a tobacco tax to achieve the same effect
- Instead of drafting through compulsory conscription military wages might be increased if there is a need for more soldiers

Auctioned permits for emitting CO2, environmental fees and emissions taxes are examples of price based instruments to correct a market failure. Also the possibility of subsidies to support desired development is another possibility whereas demand for the activity is increased as costs are reduced.[49] As shown in figure 2; according to economic rationale all abatement actions with marginal cost under a present CO_2 price (red line) will be performed:

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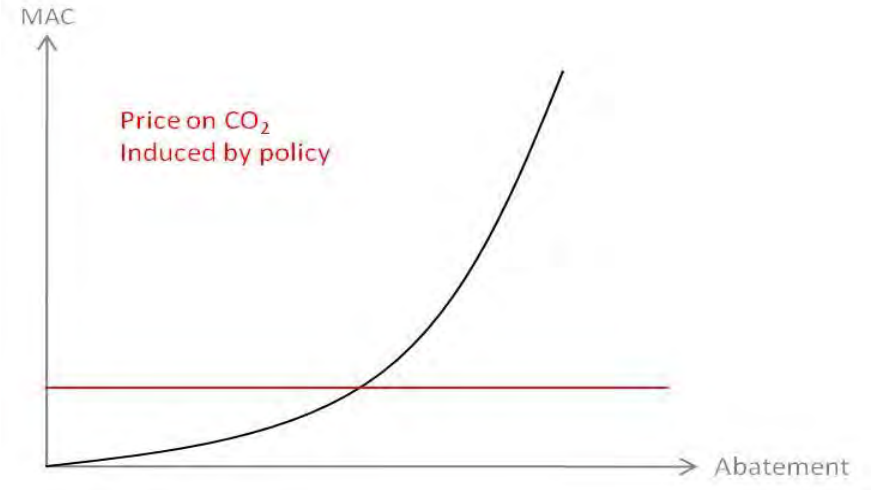
[46] Long term commitment and flexibility discussed in Hepburn 2006 and Katsoulacos et al 2001.

[47] Border adjustemnt to prevent carbon lekage discussed in Nilsson et al 2009 and Bovenberg & Goulder 2001.

[48] Hepburn 2006.

[49] Broberg et al 2008.

Figure 3: Actions with a MAC under the price on CO_2 will be performed.



Price based instruments directed at output is often less efficient than instruments directed directly at actual emissions. If a tax is introduced on every kg of steel produced, no incentive will arise for substituting components in a product process, only to decrease production. If instead actual emissions are targeted incentives exist both from reduced production and technological substitution within the production process.[50]

Flexible

Some mechanisms are flexible in the sense that they allow for corporations to finance and take credit for abatement performed outside organizational boundaries. In the EU ETS corporations might chose to buy EUA (European Emission Allowances) or CER (Certified Emission Rights) trough the Kyoto based mechanisms to meet their cap, something making it possible for abatement to be performed in most economically efficient way where MACs are lowest. Today there is though limitations to the amount a flexible mechanism might be used by a country (and thus corporations) to meet its Kyoto target. For Sweden where MAC is high compared to other countries increased use of flexible mechanisms have the potential to significantly reduce overall abatement costs.[51]

For the reader of this report it might be valuable to point out that Höglund uses flexible in another context than in the section above (edt note).

[50] Effect of where policy is targeted discussed in Fullerton et al 2001.
[51] Discussion on flexible mechanism from Broberg et al 2008.

7.9 Policy Instruments

7.9.1 Direct controls

Direct controls work through imposing technological standards, maximum emission levels (might be zero) or similar interventions. The car industry is facing stringent requirements and technological standards specifying the amount a car should emit during a set driving cycle. Another example is the requirement for a catalytic converter.

One problem with such mechanisms in a climate change context is that the policies control the total amount of emissions. If more efficient cars mean people use their cars more, emissions might even increase in the long term due to the original policy.[52]

Direct controls are effective for example when there is a need for a total ban such as on toxic substances or when there are security interests involved. The former is the case with many of the regulations concerning nuclear power plants.[53]

7.9.2 Emission Subsidies

A subsidy is introduced to support a certain development. In the case of climate change related policy one way is to support abatement related R&D or investments in technologies such as renewable energy. As subsidies do not introduce an additional cost, they generally meet less resistance from high emitting firms than other policies when being introduced.[54] If the price of goods is not affected, subsidies do not change demand for these goods automatically and no incentives for choosing a low carbon technology over high exists.[55]

According to one simulation the most cost effective way if subsidies are the sole instrument of choice to lower CO_2 emissions is to differentiate subsidies between carbon heavy industries and their counterparts. One way is by introducing a tax on R&D for carbon heavy industries while at the same time supporting R&D in their low carbon counterparts.[56] This goes against the general rule discussed earlier that policy always should be harmonized over different sectors.

Subsidies might be called for if private investments in abatement technologies or incentives for these investments are not high enough. Spillover-effects make subsidies pay back to society, but make incentives

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[52] Sterner 2003.
[53] Sterner 2003.
[54] Sterner 2003.
[55] Sachs 2008.
[56] Differentiated subsidies discussed in Fischer 2007.

for private investments lower. Most subsidies are not technologically neutral so it is more efficient to increase the carbon price through other policy instruments if that is not yet on an optimal level. As subsidies might make it more attractive for more corporations to start a business within an industry, subsidies in the long term have the possibility to increase GHG emissions. Also through subsidies society pays for abatement thus not following the polluter pays principle (PPP).[57]

7.9.3 Tradable permits

Tradable permits or emission allowances work by the government introducing a certain amount of rights to perform a task. Thus the property right of the desired task is claimed by the government. By lowering the total amount of permits emissions are lowered. The possibility of exchange of permits between different actors through a market sets a price on the action and provides signals to make up for a market failure. Either as corporations need to buy auctioned permits or when corporations chose to trade originally freely allocated permits. The thought is that efficiency is obtained when those corporations which have the MAC get funded by those with higher costs. This is achieved when corporations take measures and sell emission permits or chose to buy to meet an emission targets. Thus flexible market based systems such as permits are more effective compared to other policy instruments when pollution and related damage is the same, but costs for reducing emissions varies between firms.[58]

The amount of permits might then gradually be lowered towards a certain goal. In this way a permit policy is in control of total emission levels. But the cost for reaching that goal might not be reflected in traded price. This could be compared to taxes or fees which could be based on the calculated cost for achieving an emission goal, thus covering abatement costs.

The theory of market based mechanisms dates back to the critique of the then traditional economic analysis and theory of Pigouvian taxes[59] by Nobel Prize laureate Ronald Coase. In Coase's view externalities should be seen as a factor of production and only those actions where more is gained than lost should be performed.[60] Another view by Coase is that trade involves transfer of rights, a common view in the field of law. If rights are traded they will be bought by those where the rights has the greatest val-

[57] Content of section discussed in Broberg et al 2008.
[58] Content of section discussed in Sterner 2003.
[59] See later section on Taxes for a discussion of the concept of Pigouvian taxes.
[60] Coase 1960.

ue for production or consumption. If one utilizes his right another is deprived of his/her ability for production or consumption.[61]

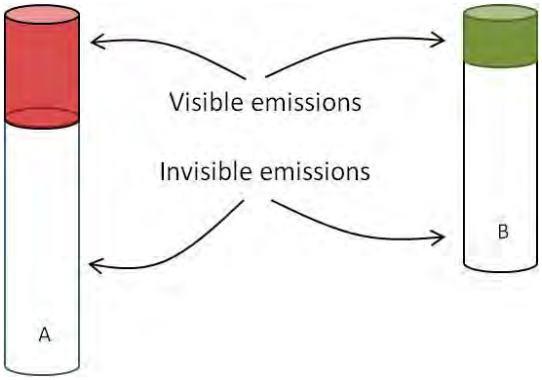
Some researchers argue that tradable permits are fairer and thus more acceptable than other types of environmental policy as decision regarding abatement are decentralized. Also compared to taxes the question of allocation and distribution of resources are automatically handled by the market mechanisms. [62]

Freely allocated permits

Freely allocated permits through grandfathering sees to it that capital stays within affected sectors. Efficiency is gained as those corporations that easiest lower emissions sell allowances to those who find it hardest thus allocating capital to low-cost-per-ton CO_2 reducing investments.

Carbon remains invisible while permits are freely allocated (see figure 3 below). Only the excess or abundance of permits is shown in the market. As so only the visible part would affect price formation and competition. Thus if a steel plant needs more allowances to continue production, only the excess emissions corresponding to allowances the plant has to buy is reflected in the price of steel. Also as these allowances are bought from another corporation, market and industry liquidity is preserved. A fact making free allocation easier to implement than full auctioning as the resistance from industry is expected to be smaller, but at the same time it reduces learning and clarification of current conditions. [63]

Figure 4: To meet its emission cap corporation A has to buy allowances from other corporations.



Corporation B has excess allowances to sell. Thus corporation A trades allowances with corporation B (and probably other actors as well), but only emissions corresponding to traded volume is made visible for market actors.

[61] Coase 1988.

[62] Discussed in Chesny & Taschini 2008.

[63] Content of section discussed in MacKenzie 2009.

Auctioned Permits

Instead of grandfathering permits governments can choose to have them auctioned to corporations that want to emit. Maximizing social welfare and the PPP makes incentives for governments to auction at least a portion of allowances. Still it is expected that industry would lobby against such development and results from the ETS show that industry has the ability to win.[64]

A market with full auctioning for obtaining permits is in many ways similar to an optimally set tax and would reach the same cost per ton CO_2. Under both policies, corporations pay for emissions either through buying permits or through paying the emission tax. During a known relationship between price and emissions thus either instrument functions alike and an increased amount of EUA corresponds to a lowered CO_2 tax and vice versa. While this is only theoretical and the relationship is unknown real world trials would end up differently.[65]

According to the National Institute of Economic Research in Sweden, auctioning is preferred to free allocation. Distributional effects, marginal impact on competition, higher economic efficiency, more clear incentives for corporations to take abatement measures and higher price stability are benefits of the system. As auctioned permits make it possible for governments to take advantage of distribution effects, PPP might be followed. Past examples also shows that markets with auctioned permits are more stable than those with freely allocated permits.[66]

Hybrid systems

The introduction of a hybrid system to gather the best of different cap and trade policies is possible. One way is for governments to guarantee to sell permits at a certain price which combines effects of taxes and emission trading. [67] This is also a possibility of EU ETS development if or when auctioning of a percentage of the allowances is introduced.[68]

7.9.4 Emission taxes

Emission taxes are a price based instrument to counter market failures by introducing a market price. Efficiency is achieved when varying amounts of abatement are taken depending on individual marginal costs. Taxes also pose continued incentives for change and might be adapted to contextual changes.[69]

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[64] Discussed in Hepburn 2006.

[65] Content of section discussed in MacKenzie 2009.

[66] Broberg et al 2008 (National Institute of Economic Research in Sweden).

[67] Nordhaus 2007.

[68] Broberg et al 2008.

[69] Content of section discussed in Pearce 1991.

One way is to set the level of a tax aiming at balancing a cost to correct for a market failure, something called a Pigouvian tax.[70] In the case of CO_2 one way is to base it on the difference of benefits and costs induced by global warming. Another possibility is to base it on the cost of performing the transition towards a low carbon economy. If a tax like this can be harmonized among multiple countries, efficiency is gained and carbon leakage overcome.[71]

As taxes raise revenue this might be returned to a sector through hypothecation or to finance other causes. A tax with hypothecation corresponds in some ways to freely allocated permits as money stays within affected industries and might therefore meet less resistance from affected corporations while being introduced.[72]

Unlike tradable permits and other quantity based instruments there is, in a climate context, uncertainty regarding the level of emission reductions induced by certain tax level. It is also hard to estimate how different business will respond and the pace of change. Thus there is a need to adjust taxes along the way to reach certain goals. On the other hand taxes might be based on raising the capital needed to perform a low carbon transition or curbing climate change. To conclude, taxes raise needed capital but might miss the overall goal while emission trading sees to the goal but without a guarantee of raising required capital. The increased price induced by a tax also affects labor, trading and economic development. Policies that recycle capital and costs to counter balance these effects are according to some research preferable to those that do not.[73][74]

If taxes are introduced keeping tax neutrality through hypothecation or similar, total tax burden is preserved. As other taxes are lowered, productivity is increased and for example reduced income taxes increases demand for labor. If tax neutrality is not kept and the total tax burden increased, there is risk of unemployment, increased costs for production, and a decreased tax base.[75]

Other researchers however disagree. Hypothecation of taxes would, according to simulation of the US market, be ineffective. If costs for an industry are neutralized, affected corporations are over compensated. Still, some subsidies might be needed to provide incentives for corporations to invest in R&D and for equity values to be preserved.[76]

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[70] See Pigou 1912 for original discussion.
[71] Nordhaus 2007.
[72] MacKenzie 2009.
[73] Content of section discussed in Hepburn 2006.
[74] Stern 2009.
[75] Rauscher 2001.
[76] Simulation origins from Bovenberg & Goulder 2001.

When it comes to earmarking or hypothecation of taxes policy and political systems differ between different countries and regions. In the US it is commonly used where as the European Union and its member states are negative towards it.[77][78]

Introducing equal harmonized taxes is often seen as fair as everyone is paying the same price. Still distributional effects must be taken into consideration and are needed to be dealt with through side payments.[79] But as shown by the efforts during the 1990's discussed earlier, it is in many cases hard to implement harmonized taxes politically.

Not the least – to introduce a harmonized tax on a European Union level all member states must support it. At the same time to introduce a trading system a qualified majority is enough as this is considered an environmental matter. On way to pass this obstacle is to call it an environmental fee as this sometimes has other requirements than if defining it as a tax.[80] The extent this might be utilized should be focus of future research.

Tradable permits have the advantage that refund mechanisms are easier as this is automatically handled by market mechanisms. A global CO_2 tax would, if handled by an international agency, need mechanisms for how raised capital should be used. A tax based on harmonized national taxes would face the problem of how to make adjustments flexible and feasible enough. But a harmonized tax is by many seen as fair in that respect that it creates predictable and equal incentives for abatement as a multinational price on CO_2 emissions would be introduced.[81]

The level of a tax is in real world examples often based on trial and error. If abatement is too slow the tax is increased and vice versa. Here one main disadvantage of taxes comes to life as introducing or modifying taxes involves complex legal and political processes.[82]

One argument is that because of the uncertainty regarding climate science, economics and policy, emission fees or taxes are likely to be more efficient than tradable permits. Especially risk adverse firms rate tax based instruments as more efficient as they are not forced to face volatile prices and uncertainty.[83]

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[77] According to conversion with officials from the Foreign Ministry of Sweden 2010.
[78] Discussed in Sterner 2003.
[79] Hepburn 2006.
[80] Sterner 2003.
[81] Content of section discussed in Sterner 2003.
[82] Sterner 2003.
[83] Discussed in Hepburn 2006.

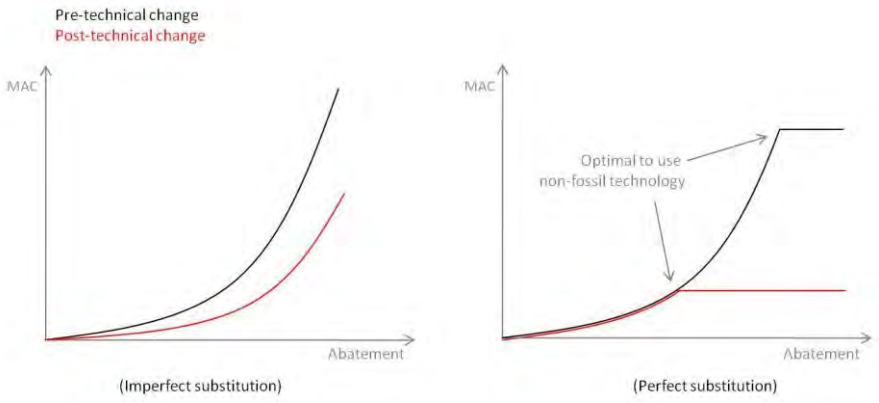
7.9.5 *Induced Technological Change*

Induced Technological Change (ITC) is the bringing forth of additional technologies that would otherwise not be present. Some policies act as technology-pushing, boosting innovation through standards, funding for R&D etc. Others policies such as taxes or tradable permits provide a demand for new technologies on the market.[84]

While some policies aim directly at providing incentives for ITC, it is an indirect effect of others. A carbon tax or similar aimed at reducing CO_2 emissions will support ITC, but if a higher level of ITC is desired the policy must be combined with another such as subsidies or R&D funding. [85] Thus following one policy per goal discussed earlier in this report.

Technologies made available through ITC pivots the MAC-curve downwards thus lowering the cost for providing a carbon free economy (See figure 4). Such technologies reduce the cost for non-fossil based energy sources. If the substitution between the non-fossil technology and present fossils are imperfect the reduction in cost for the non fossil does not have a proportional effect on the total MAC-curve. If there is perfect substitution the fossils will be used until a kink is reached where it is economically rational to substitute for non-fossils. Technical change in this case means the kink comes earlier.[86]

Figure 5: Technical change that lowers MAC[87]



[84] Content of section discussed in Goulder 2004.
[85] Discussed in Barbiroli & Focacci 1999 and Broberg et al 2008.
[86] Content of section discussed in Baker et al 2008.
[87] Further discussed in Baker et al 2008.

During technological progress many firms will gain cost savings both from internal R&D and spillovers from the diffusion of competitors' or other organizations' R&D. This spillover effect makes the total gain from innovation larger for the whole of society, but at the same time reduces the internal will of a firm to innovate.[88]

Also a policy announced in advance leads to larger emission reductions than a policy that comes without warning. An early announced policy starts R&D efforts before the policy is implemented and corporations might keep costs down by spreading related expenditures over a longer time period.[89]

In the same way, expectations of future policy adjustment affect incentives for investment in R&D and abatement technologies. Thus corporations will invest more if future prices are expected to increase and less if future lower prices are expected. Also the ability for corporations to capture the gains from investments affects incentives for investments. Spillover effects where competitors and others can take advantage of one actor's development reduce private incentives for R&D investments and innovation. On the other hand, spillover effects increase social benefits from innovation and thus their presence ratifies public investment and support.[90]

When looking at the incentives for innovation and diffusion of technologies through ITC researchers disagree on how policy works. One argues that taxes and subsidies provide the greatest incentives follow by free permits and direct control, and that auctioned permits comes last. [91] Another argues that because some carbon remains invisible during free allocation it does not affect polluting firms. With auctioned permits carbon is visible and flexibility through trading which leads to effective usage and distribution of resources, as well as learning effects.[92] As carbon price is affected by abatement, incentives for competitors to adopt a new technology introduced by a competing firm are lowered during trade with permits. [93]

One way of promoting ITC is by differentiating CO_2 policy between carbon heavy sectors and others. Growth and technological development will thus be higher for low carbon technologies than for their counterparts. Gains from ITC also improve overall efficiency resulting in CO_2 poli-

[88] Spillover effects discussed more thoroughly in Fischer 2007.
[89] Goulder 2004.
[90] Content of section discussed in Fischer 2008.
[91] Baker et al 2008.
[92] MacKenzie 2009.
[93] Sterner 2003.

cy paying for itself.[94] A policy providing enough incentives for ITC could lower overall abatement cost by up to 51% according to one simulation.[95]

According to another simulation ITC accelerates the substitution to carbon free technologies substantially and might increase abatement by a factor of five compared to what would be achieved during a constant carbon tax of 25 $/ton CO_2 during this century.[96] Other researchers argue that abatement is best performed through policy targeted at reducing emissions. Technology supporting policy only puts new products on the shelf faster, but there must be a demand for picking them up.[97]

7.9.6 Hedging the risk of climate related policy

Market volatility leads to increased costs and suboptimal investments. Lessons can be learned from the power industry where corporations benefit from reducing cash flow related risks. Because the energy sector relies on large capital investments for setting up power production and distribution, the relevance of risk related investment incentives are increased. To reduce this risk, power companies have been using forward contracts as a hedging mechanism.[98]

In a traditional future or forward market a contract is established for delivery of a physical good or resource at a set delivery date. This is a common case under the EU ETS where EUAs are traded trough forward contracts. Tradable permits that are either submitted from governments or traded in a market are seen as intangible assets.[99]

Forwards and futures markets have two main functions: price discovery and risk transference. The price discovery function works if the futures contract and spot price resembles each other on maturity date. If not, economic decisions made on the basis of biased futures trading might add inefficiency to allocation of capital and resources.[100] Evidence from the Australian equity index shows that futures with one, two or three months maturity are good at forecasting a spot price. Futures with six or more months of maturity are less so, thus increasing the cost for hedging.[101] These characteristics of futures are referred to the unbiased prediction hypothesis and have shown to be valid for some markets and not for others.[102]

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[94] Otto et al 2008.
[95] Goulder 2004.
[96] Gerlagh & Lise 2003.
[97] Fischer 2008.
[98] Content in section discussed in Bessembinder 2002.
[99] Juridical definition of emission allowances discussed in Deloitte 2007.
[100] Goss 1983.
[101] Ivanovic 2004.
[102] Barry (1983).

The function of hedging risk exposure through trading futures contracts is commonly used by many corporations, not least banks.[103] Futures traded on EEX do not comprise a physical settlement on delivery date; instead the derivate is primarily used as a hedging instrument against market uncertainty.[104]

Simulations of the US electricity markets show that forward prices exceed spot prices when expected demand or demand volatility is high.[105] Similar values are obtained while values of the EEX electricity future market where simulated.[106]

Electricity is not storable in any efficient way so demand and supply must be balanced continually. Some demands, like the differences between seasons, are easy to estimate while others change within hours. As tradable permits under EU ETS may be banked they lack this discontinuity. But other costs induced by other systems such as regularly adjusted taxes or fees could share similarities.

7.10 A flexible CO_2 fee

Some researchers have modeled alternative systems which use other mechanisms for handling market failures efficiently. One such suggestion is to apply insurance mechanisms to generate a carbon price that reflects the global economy's dependence on Earth system stability.[107] Another is to use a flexible fee where trading with future contracts sets the level of a frequently adjusted environmental fee.[108] The later will be discussed below.

The main concept of the proposed policy is to introduce a Pigouvian tax or fee on CO_2 emissions where the fee level is based on market signals rather than set by a central authority. The fee is frequently adjusted to induce uncertainty which leads to a need for the trading of futures contracts as corporations seek to reduce their risk exposure. As uncertainty is introduced, trading in futures contracts will appear by itself, so the only government intervention is to change the price of the fee regularly. The spot price from this trading sends signals for how the fee should be adjusted through the price discovery function of the futures trading. [109]

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[103] Broll & Wong 2010.
[104] Bierbrauer 2007.
[105] Bessembinder 2002.
[106] Bierbrauer 2007.
[107] Phelan et al 2010.
[108] Höglund 2010.
[109] Sanctuary & Höglund 2006.

The theory is according to Höglund that as corporations are introduced to limited amount of uncertainty they expose their action costs and thus the optimal level of an environmental fee that otherwise would be hidden. [110]

The difference from traditional futures trading is that no physical product is exchanged at the time of contract expiration. Only the difference between the actual fee and the forward contract is exchanged. Thus these futures contracts are not based on a physical asset and therefore the concept of an endogenous futures market is proposed by Höglund.[111]

Corporations might either choose to buy futures contracts to ensure a low enough price or sell contracts to secure payback on abatement investment.[112] This leads to some flexibility similar to tradable permits when it comes to efficient distribution of capital. To increase market liquidity speculation amongst external actors is proposed to be allowed.

Criticism

In many industries where it is not common to hedge, the proposed policy might find resistance as they lack understanding of how it is performed or that stockholders chose to hedge their portfolio instead of allowing a single corporation to perform it. It is also in some ways controversial for people to make fortunes on other corporations avoiding environmental degradation. Acceptance could though be reached when raised capital is used for the common good. Another critique is one Höglund often faces from economists: that there must be an underlying asset for a future market to work, although he argues that this would be an endogenous market.[113]

7.10.1 SWOT

In this part of the report different characteristics of the by Höglund proposed fee is discussed and analyzed within the theoretical framework outlined earlier in this report with the aid of the SWOT structure.

Strengths

From a policy perspective an environmental fee on CO_2 emissions does affect demand for carbon based products as prices are increased. Revenues raised by the fee can be used effectively for other causes or for hypothecation to stimulate a sustainable demand in the economy. According

[110] Sanctuary & Höglund 2006.
[111] Höglund 2010.
[112] Höglund 2010.
[113] Höglund 2010.

to Hoglund in the flexible fee concept a full, and budget neutral repayment of the fee revenue in equal amounts to all individuals is preferred.

As discussed earlier, one of the main obstacles to overcome while designing a carbon fee is to determine its level. Trial and error are today frequently used so the price discovery function of futures contracts is valuable. Also as participation in futures trading is proposed to be noncompulsory, but paying the fee compulsory, the system might be implemented alongside other policies.

When it comes to risk transference, the proposed fee does make a possibility for corporations to reduce risk to secure cash flow. When outside market actors are allowed to trade, liquidity is raised and transactions more fluent and risks spread among more actors. The proposed fee also in some ways handles distributional effects which would lead to efficient abatement.

Weakness

If the futures market is successful the price discovery function will work. Still many examples exist when futures contracts are biased estimators of market spot price. If so a tax adjusted to follow spot price would be inefficient and set at a wrong level. As Höglund states himself he has gained critique from economists that there must be an underlying asset for a future market to work which also adds uncertainty regarding the proposed policy functional capacity. However, it is proposed that the fee is set by decree, but with a close view and analysis of the fee futures price on the market, for as long as it takes to prove the functionality and viability of the fee futures market.

While trading of futures contracts does lower cash-flow related risk, the introduced uncertainty leading to corporations buying futures contracts is a negative incentive for long term investments. Futures trading are effective a few months in advance, but strategic decisions and long term investment needs a perspective of many years. As discussed earlier in this report a policy with long term commitments is both asked for and more effective. Thus the proposed system might not provide as large incentives for ICT as other alternatives.

As mentioned above, a political commitment to regularly adjust and increase the fee to meet environmental demands will add a strong incentive for long term investments.

The PWC study shows that corporations see present policy systems as ineffective, inconsistent and unclear. There is a risk that that this view would pervade for this “new” system as well. To participate, corporations must learn how to trade and utilize futures contracts. This redirects resources away from core business.

One positive aspect of the proposed system is that it might be implemented alongside existing systems. Still, the system is based on finding its own price. This counteracts harmonization with other coexisting systems and leads to economic inefficiency. There is also the question if

the system will be as effective as other flexible systems when it comes to distribute capital to low MAC options.

Opportunities
Many countries and not least the EU member states have CO_2 taxes today. To implement the proposed fee system, existing tax infrastructure could be used and the most important factor is for politicians to commit to frequently adjustments. Also the possibility exists to make the new system with free participation part of an existing system.

Taxes are culturally generally preferred among many European states over cap and trade systems. As such, the new system could find acceptance from these countries. Taxes are also seen by many economist researchers as more economically effective than other systems although this is debated. More corporations are also in favor of a tax than a cap and trade system. By naming the tax equivalent an environmental fee much of the negative bureaucracy, politics and juridical matters regarding taxes could be avoided.

Threats
Even though taxes are seen as a better alternative by many there is acceptance amongst those participating in a permit system. History shows that industry lobbyists will work against an implementation of new costs. This could though be counterbalanced if hypothecation was introduced or total tax burden kept at level.

The problem with hypothecation though is that politically it might be hard, to implement. To implement a tax on an EU basis in the long term would also be hard as consent from all member states is needed. There is in this view uncertainty regarding how an environmental fee could be implemented. Furthermore, the differences in MAC between different actors predicate the use of a system to allocate resources in the most efficient way. Also if the price discovery function of the future market is biased overall efficiency will be lower or lost. Some political systems might not support taxes to frequently be adjusted either and the question is how that would regard a fee?

7.11 Conclusions

The truth about environmental policy is that there is no consensus of a policy that is always the best for all situations. While some argue for a cap and trade system like the EU ETS, others see a tax as more efficient.. Decisions on policy instruments are often based on political factors and regional preferences. Research has shown that in theory an optimally set tax and trading scheme would in many respects correspond to each other and has the same outcome.

A flexible fee system would optimally in theory have similar outcome to both a tax and trading system. In reality no system performs optimally and EU ETS is no exception. Here feedback from futures trading could improve upon present ways of setting tax levels or caps and thus add overall efficiency to the system. Research has shown that sometimes futures markets are very effective at price discovery and short term risk transference. If unbiased such system would improve environmental policy making and would be applicable for other environmental causes than global warming, such as phosphorus depletion.

During implementation some policies are also expected to be more fiercely lobbied against than others depending on how they are perceived by corporations and different countries. All polices have their strengths and weaknesses. Still there are some aspects while designing a policy which contributes to making them more efficient.

Corporations are generally today positive to the introduction of climate policy but are dissatisfied with present systems. These are seen as ineffective, inconsistent and unclear. Especially sending long term signals is asked for to provide incentives for investments in R&D. While considering investments, corporate leaders must take into account the perceived future, sometimes as much as 10 years ahead. But long term commitments do not only reduce policy related risks affecting investment decisions, it also makes it possible for corporations to plan and implement response to new policy in advance.

When implementing new policies there should optimally be one policy implemented per goal to be achieved. Policy is also most efficient if directed directly at the source for achieving this goal. If one policy is directed at actual emissions, another is needed to stimulate a parallel goal of technological development. For example one policy might put new products on the shelf while another creates a demand for taking them of the shelf and into a market. If there are parallel policies with the same goal, efficiency is gained when policy outcome is harmonized.

In a climate change context the costs and possibility for different abatement options to be performed differs. To achieve economic efficiency and social utility it is important that abatement is performed where marginal abatement costs are lowest at first and options with higher costs last. Therefore optimal policy should be designed to provide incentives for capital to be invested in low cost options. This also adds to the need for parallel systems to be harmonized as to direct resources in the most efficient way. If policies are not at level investments will be made where relative policy pressure is highest and thus lead to economic inefficiency.

Hypothecation or earmarking of taxes and fees is asked for by many corporate leaders and researchers. During the process with this study it has come clear that there is often a lack of understanding from both corporations and researchers of how political and juridical obstacles affect different policy and the possibility to implement them. Even though

many of the reports included in this study give advice for policymaking only a few discusses this matter.

The political framework in Europe makes a harmonized tax hard to implement as all member states must support it. The framework also counteracts earmarking of capital raised by taxes. This affects the possibility to design and implement many policies. In the same way juridical and political process counteracts frequent adjustment of a tax.

The differences between a tax and a fee need to be highlighted. A sufficiently flexible and budget neutral CO_2 fee with a full rebate could be a major step towards a solution to the potential juridical and political obstacles. To evaluate this concept and its democratically viability should be given a high priority.

Mapping these obstacles would therefore be a valuable addition to present research and would provide a basis for how and which policies should be included in mathematical and economic modeling. Today corporate lobbying and resistance is often included in analysis and discussion of policy instruments, but the political dimension left out. An increased understanding and mapping would add a more important perspective to this.

Many researchers as well as corporations argue that international competition calls for harmonized or international emissions policies. One way to counter regional differences in policy is utilize border adjustments. The basic idea is to let corporations deduct costs induced by climate policy while exporting goods at the same time as imported goods are target of costs harmonizing policy induced prices with those of internal production. The theory of border adjustments to decrease regional influences on competition should be analyzed and modeled more thoroughly in a European context. Also the influence of international trade agreements needs to be included in the present discussion.

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8. Appendix 2

8.1 About the Foundation

Established in 1995, the Foundation's purpose is to offer systemic approaches and solutions to the challenge of developing society in a sustainable way. The Foundation develops and supports the development of these solutions mainly in the area of economics. The Foundation takes a non-political, holistic approach to promoting these solutions through research and development, education and spread of information.

8.2 The Foundation's view: harness market forces to create a prosperous and pollution-free society

Although large inputs of energy are good for the economy, the damage from emissions and use of natural resources, like water, may create costs far outweighing the benefits of this growth

Photo: Flikr /Daniel

8.2.1 market forces

The Foundation recognizes that market forces represent a powerful, dynamic potential to change that could be harnessed to promote sustainable development.

8.2.2 *Emissions will ultimately cost*

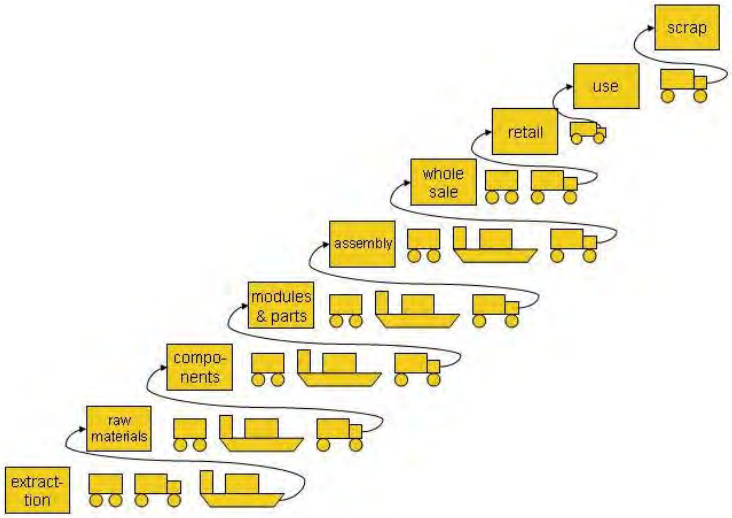
On the other hand, market forces alone do not bring sustainable development and can ultimately present society with huge costs if emissions, for example, are not curbed.

8.2.3 *The purpose of this white paper*

This paper examines the pricing of emissions and depletion of natural resources. It analyses the interplay between development of supply chains, economic growth and the costs to society of emissions, resource depletion and waste handling. It introduces the subject of emission fees, and the use of market forces to stimulate clean technology (cleantech) and the development of a culture appropriate to nature. Later sections present the Höglund flexible emissions fee mechanism as a way of stimulating this development, using the principles of dynamic control Höglund developed for diesel engines, among others.

For readers seeking more advanced knowledge the paper provides footnotes, references and sections offering deeper analysis.

8.3 Global supply chains bring us all kinds of goods – and tie us into dependency on finite materials



8.3.1 *Supply chains bring goods and services to modern consumer*

In striving to reach high levels of organizational effectiveness and efficiency, services come to consumers via long supply chains of interlinked, highly specialized firms. The chain starts with raw materials, like sand,

which make up components in, for example, electrical devices which eventually end up in the refuse collection system.

Public and private waste streams represent an additional cost for the product over its lifetime, especially if biological and mineral nutrients are emitted to burden and degrade the environment However, waste streams also represent potential sources of raw materials for new products.

8.3.2 The accumulation of biological and mineral substances in society

The range of products available today to the average consumer comes at a price to societies and the environment in all segments of the chain. Along the supply chain, emissions flow into natural and societal sinks. In many cases, the substances are in a form that makes them in principle unrecoverable. (For example when metals are in special alloys, or materials are fixed together.)

In other cases, these materials represent a biological burden on ecosystems (e.g the Baltic sea is experiencing algal bloom due to excess nutrient emissions)

As an illustration, the table below shows the massive throughput of materials needed to keep London functioning.

Material throughput of London, UK population circa 7.5 million

Input, millions of tonnes	
Water	1,000
Food	2.4
Fuel	20
Timber	1.2
Plastics	2.1
Metals	1.2
Glass	0.36
Cement	2
Building materials	36
Oxygen	40
Paper	2.2

Output, millions of tonnes	
CO^2	60
Household waste	4
Industrial waste	11.4
SO^2	0.4
NOx	0.28
Sewage	7.5

Source: New scientist

An example of waste streams pouring massive amounts of potentially useful material into the biosphere is that of accumulation of plastic in the oceans. Reporting in the journal Science[114], researcher Richard Thompson, a senior marine ecology lecturer at the University of Plymouth, says "the action of waves and the elements work to break plastic objects down into fragments tiny enough to be ingested by countless other marine organisms."

He argues that the very life of animals in the sea may be threatened. Apart from releasing potentially dangerous chemicals plastic also absorb toxins. These may then be transported to organisms that eat the plastic."

Such toxic chemicals include PCBs (polychlorinated biphenyls) and DDE (dichlorodiphenyldichloroethylene), which are derived from pesticides and other manmade substances. These agents are known endocrine disruptors—chemicals that interfere with the reproductive, developmental, and immune systems of animals.

Some idea of the scale of this accumulation can be gleaned from how researchers from the Algalita Marine Research Foundation in Long Beach, California, found that the mass of plastic fragments in parts of the central Pacific Ocean is six times greater than that of resident plankton.

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[114] Thompson et al.(2005). New Directions in Plastic Debris Science18 November 2005 http://www.sciencemag.org.

8.3.3 Legal control and enforcement lag behind development

Commercial development naturally moves faster than the development of legislation and control. This can lead to situations where the economic realities surrounding a business make it cheaper to, for example, use materials mined in a far off country and shipped to its factory, rather than recovering materials from its already sold and discarded products.

Recycling, repairing and reusing all sound like strategies that would use less energy, be simpler to manage and represent a better solution for society as a whole. In practice, however, firms demonstrate de facto that there is more profit in a linear, energy intensive approach to material handling.

Model T ford 1923. Photo: Biscuit in pursuit, FlickR

Take the example of fuel economy: the 1908 Ford Model T went at 25 miles per gallon. As of 2004, the average fuel economy of cars and trucks was 24.6 miles per gallon[115].

[115] See http://www.dailyfueleconomytip.com/miscellaneous/100-years-of-improvement/.

8.4 Waste represents a market failure and is a sign of inefficiencies

8.4.1 Market failure and externalization

In today's complex societies and supply chains, then, costs incurred for the provision of products and services with the extraction, production, supply and disposal of materials are not all born by the firms along the supply chain.

Costs for everything from educating workers, to health care, for roads, railways, and for cleaning up pollution and for refuse disposal are not fully born by the firms. This is called externalization of costs[116]. When society incurs harsh costs for externalization, for example when air pollution causes health care burden, the term "market failure" is used[117].

Waste in itself actually represents unused resources and are signs that society is not functioning as efficiently as it could. Waste represents business potential given the right conditions.

The Foundation sees these failures as situations where the context within which the firm operates is not effective in ensuring that market forces preserve the environment or health.

> The failure to effectively internalize harmful externalities in the economic system, pervading almost all aspects of human life, has resulted in an unsustainable lifestyle and a potentially lethal conflict of interests both locally and globally.
>
> Anders Höglund, TSSEF

Identifying ways to create a context for market forces to operate within where costs are not externalized must be the major tasks of governments. At the least, it befalls government to do everything in their power to introduce monitoring and control mechanisms to curb externalization as they have no mandate to allow degradation of the nation's ecosystem or depletion of resources human, natural, mineral or otherwise.

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[116] The question of the environment is viewed, in the traditional economic framework, as being related to the externalization of costs. That is, market economics assumes that a good which is underpriced, is overconsumed. Externalization of cost, in this view, will be corrected by pricing the overconsumed resources which are being used, for example the work of Lester Thurow and also see Pigovian taxes. Not all economics study accepts this paradigm, and, instead, there is a seven decade old tradition of viewing economic relationships as being based on the scarcity of energy, rather than price, as the central feature of economics.

[117] One definition of market failure is: "A condition that arises when unrestrained operation of markets yields socially undesirable results".

Fostering dependence on finite resources is an unsustainable long-term strategy for societal development

Many long-term visions of business expansion and development of nations take no account of the availability of essential material. For example: according to a study, titled "Metal Stocks and Sustainability,"[118] all of the copper in ore, plus all of the copper currently in use, would be required to bring the world to the level of the developed nations for power transmission, construction and other services and products that depend on copper. The researchers believe scarce metals, such as platinum, risk depletion in this century because there is no suitable substitute for use in devices such as catalytic converters and hydrogen fuel cells. They also found that, for many metals, the average rate of use per person continues to rise. As a result, the report says, even the more plentiful metals may face similar depletion risks in the future.

There are energy constraints to growth too. To quote sustainable development expert Richard Heinberg;[119] "The most cursory examination of our current energy mix yields the alarming realization that about 85 percent of our current energy is derived from three primary sources—oil, natural gas, and coal—that are non-renewable, whose price is likely to trend higher (and perhaps very steeply higher) in the years ahead, whose EROEI[120] (net energy yieldfor energy used for extraction) is declining, and whose environmental impacts are unacceptable."

Several technological changes we have witnessed over the last decades have been rapid: the spread of mobile phones, the Internet, digital music players. All of these examples are, however, light in terms of materials and energy intensity. Technological infrastructure like transport systems, power generation and waste water purification and handling all take decades to transform. A report sponsored by the United States Government[121], concludes: "The depreciated value of existing U.S. transportation capital stock is nearly $2 trillion and would normally require 25 – 30 years to replace."

Another report, by the Pacific Institute on behalf of Ceres, [122] finds that water stress is rapidly becoming a key strategic risk to commerce. Several business sectors are at risk, including clothing production, food production, metals and mining and electricity production.

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[118] Proc. Natl. Acad, Sci. USA. By Robert Gordon and Thomas Graedel of Yale University and Marlen Bertram of the Organisation of European Aluminum Refiners.

[119] http://richardheinberg.com/MuseLetter_203_March_2009.html.

[120] Energy Return on Energy Invested. For a deper discussion of the relation of EROEI see the article at http://www.chrismartenson.com/forum/implications-eroei-peak-oil/11020.

[121] Peaking Of World Oil Production: Impacts, Mitigation, & Risk Management, Robert L. Hirsch, SAIC, February 2005.

[122] http://www.pacinst.org/reports/business_water_climate/full_report.pdf.

Material suppliers, like oil companies and metals and mining, have an economic interest in businesses being dependent on their materials. Their mandate is to maximize profits as long as possible until the asset runs out. Conservation, taking depletion into account and minimizing societal dependency risks are not written into the articles of association that govern these organizations. The formation of legal bodies operating under these tenets is accepted practice, the benefits of the creativity and effectiveness these structures unleash is seen as outweighing their downsides.

Given that businesses cannot be expected to act in the interests of the national economy, and that replacement of existing heavy infrastructure would take a long time, and given the scarcity of metals and impending lack of water, governments would be wise to start to:

- steer their country's economy to be less dependent on finite materials
- ensure the ecosystem can provide water, building material, wood for fuel, etc. in sufficient quantities to supply essential services

In a declining economy, loss of faith in market forces will bring demands for sanctions regardless of the promise of market forces. Thanks partly to the development of modern media, consumers are becoming more aware of how global supply chains work, the conditions of the workers along them and the downsides of the emissions created. Increasingly, opinion is going against the negative sides of these practices and, in the light of the current economic downturn, a negative backlash against the highly paid executives who control these chains.

If banks and large corporations are to retain their credibility and license to continue, consumers and voters need to be assured that mechanisms are in place to ensure that externalization is effectively controlled, and development is moving in a positive direction.

8.5 The argument for restriction of emissions and material depletion

Restricting emissions and depletion:

- Ultimately reduce material supply costs to businesses
- Encourages recycling and breaks dependence of the economy on finite resources
- Preserves the ability of the environment to provide vital services
- Ensures the long term stability of the economy

There are four main arguments the Foundation puts forward for governments to start now to develop restriction mechanisms on emissions and material depletion.

Firstly, that the extraction, refining, transport and processing of materials is cheaper than recycling represents a temporary dysfunction, or market failure. This has come about in part, as civil rights groups make us painfully aware, through social inequalities along the supply chain. As materials continue to deplete and living standards rise, businesses relying on cheap raw materials will be badly hit. As larger industries, like the transport industry, have long replacement cycles, these need to start to adapt in a timely fashion to preserve long-term economic stability.

Secondly, emissions and accumulation of materials create costs and represent unused potential. An economy which uses energy and materials effectively is more competitive than one that takes energy invested in mineral extraction and literally dumps it on a waste heap[123].

Thirdly, as consumers and voters are becoming aware, material accumulation can damage ecosystem services which affects productivity and ultimately slows economic growth.

Finally, restricting material depletion reduces the risk of businesses being forced into dependency on cheap and available materials.

8.6 Defining system boundaries for emissions control

In which areas do we urgently need Government control of emissions? To answer this question we turn to the following illustration from the paper published in Nature called "a Safe Operating Space for Humanity.[124] According to the paper, responsible management of releases to the environment needs to encompass these nine areas. The three areas in red are particularly acute, with phosphorus trailing close behind.

[123] The book "Cradle to Cradle" (see references) argues that extraction and emission need never occur in the future, and economic growth is dependent on reuse and recycling of resources.

[124] *Nature* 461, 472-475 (24 September 2009) | doi:10.1038/461472a; Published online 23 September 2009.

PLANETARY BOUNDARIES

Earth-system process	Parameters	Proposed boundary	Current status	Pre-industrial value
Climate change	(i) Atmospheric carbon dioxide concentration (parts per million by volume)	350	387	280
	(ii) Change in radiative forcing (watts per metre squared)	1	1.5	0
Rate of biodiversity loss	Extinction rate (number of species per million species per year)	10	>100	0.1–1
Nitrogen cycle (part of a boundary with the phosphorus cycle)	Amount of N_2 removed from the atmosphere for human use (millions of tonnes per year)	35	121	0
Phosphorus cycle (part of a boundary with the nitrogen cycle)	Quantity of P flowing into the oceans (millions of tonnes per year)	11	8.5–9.5	~1
Stratospheric ozone depletion	Concentration of ozone (Dobson unit)	276	283	290
Ocean acidification	Global mean saturation state of aragonite in surface sea water	2.75	2.90	3.44
Global freshwater use	Consumption of freshwater by humans (km^3 per year)	4,000	2,600	415
Change in land use	Percentage of global land cover converted to cropland	15	11.7	Low
Atmospheric aerosol loading	Overall particulate concentration in the atmosphere, on a regional basis		To be determined	
Chemical pollution	For example, amount emitted to, or concentration of persistent organic pollutants, plastics, endocrine disrupters, heavy metals and nuclear waste in, the global environment, or the effects on ecosystem and functioning of Earth system thereof		To be determined	

Boundaries for processes in red have been crossed. Data sources: ref. 10 and supplementary information

The challenge is to identify national or international supply chain entry and exit points into the systems above. Flexible fees can then be introduced to control them.

As an example, the Earth-system boundary is crossed by carbon dioxide when burning fossil fuels. Entry points into the supply chain are at extraction or import. Here import duties or extraction duties could be applied.

For plastics, fees could be levied on sales of raw plastic pellets, and discounted when pellets are produced from recycled plastic.

8.7 The argument against maximisation of gnp as progress yardstick

It has been claimed that emissions fees sufficiently high to galvanize a migration to non-polluting technology would reduce economic growth and create more harm than good. The truth is that every fee in the econ-

omy is also a revenue. What determines the real economic result is how the money is used.

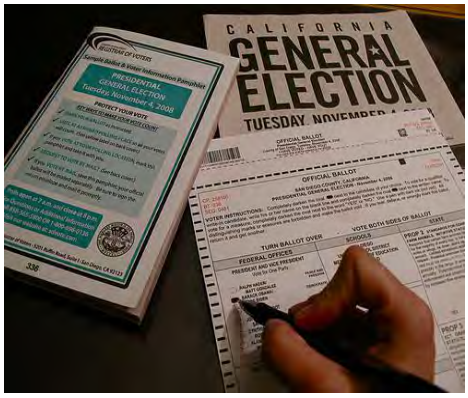
It is common in model calculations of the effects of emission fees on the growth of GNP to ignore the fact that the GNP figure does not only include produced benign goods and services but also, to a large fraction, products and activities that are both unwanted and/or directly harmful. Therefore it is a mistake to believe that maximum GNP growth is the most important criterion when ranking different development alternatives.

8.8 Need to control emissions while retaining economic growth

As illustrated above, Governments have no legal mandate to allow degradation of a nation's resources, yet they have the task of stimulating economic growth short term as well as long term.

Clearly, they need to demonstrate that control mechanisms are in place to curb externalization whilst creating the conditions for economic growth.

Increasing taxes is often called for to require polluters to cease. (This approach is called Pigovian taxation.[125]) However, taxes are traditionally difficult to apply effectively and are seen as an unpopular way to exercise government.



Politicians face the question: how can we preserve the environment, reduce waste and be seen to be stimulating economic growth at the same time?

[125] Because the market mechanism fails to factor in the total cost to society, output decisions are flawed, resources are allocated inefficiently, and social welfare is reduced. One method of reducing the effect of this market failure is to impose a tax equal to the amount of the negative externality (or impose a subsidy in the case of a positive externality).

8.9 The problem with regulation

Regulation as a strategy can backfire. If it is more profitable to break regulations than to keep them, there will always be a temptation to break the rules. In such a case, regulation will bring with it costs of enforcement and prosecution. If it is profitable to abide by regulations, then the incentive will be to follow the regulations.

Example: CO2 emissions from cars.

Reducing the CO2-emissions from new cars, by imposing a maximum allowed level of CO2-emissions measured in grams/km, is not a good idea. In reality it is a textbook example of bad economics due to the fact that the real cost of reducing those CO2-emissions is many times higher than achieving exactly the same emissions reduction by treating all CO2-emissions the same by using one single CO2-fee.

8.10 The problem with emission rights trading

Emission rights trading is the notion that by allowing trade of emission rights, they will become more expensive and thereby encourage less emissions. This system has not demonstrated that it produces a rise in the price of emission permits. In its simplest form, it does not aim at reducing emissions, just the distribution of the rights to emits.[126]

8.11 The problem with appealing to people's good nature

The conception that the environmental problems facing humanity can be solved by informing and educating people to change their lifestyle and take a personal (economic) responsibility for the global problems, may be based on good intentions but unfortunately this conception is not only ineffective but also counterproductive since it has shifted the focus from, and delayed, the elimination of life-threatening systemic errors.

For example: they may taste better, and give a better conscience when eating them. They may even be better for health, but organically grown vegetables, which are always far more expensive than conventionally grown vegetables, have not succeeded in taking over the market.

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[126] The problem with trading rights can be illustrated with an extreme example. Consider child abuse as the externality to be reduced. Say you allow everybody to strike kids, e.g. 10 times. Since some people do not like hitting kids, or have found other ways to communicate with them, they can sell their "hitting rights" to other people, more prone to hit kids. This way, the total amount of child abuse would not diminish, but you have created a new market.

8.12 The promise of cleantech applied to existing technical infrastructure

As argued above, existing technical infrastructure represents a huge investment and takes a long time to replace. For example, diesel engine technology is not only widespread in trucks, boats, electrical generators etc, but is supported by a network of suppliers, manufacturers, service networks and surrounding technology it is integrated into, for example, vehicle electrics and control systems.

A rapid dismantling of such technology, so integrated into the fabric of society would be costly, time consuming and wasteful of the capital, materials and intellectual, invested.

In this context, the existing technological landscape presents a barrier to new advances. Its introduction to be successfully will require massive investments in changes to the existing technological landscape.

On the other hand, existing technology carries a legacy of inefficiency and high emissions.

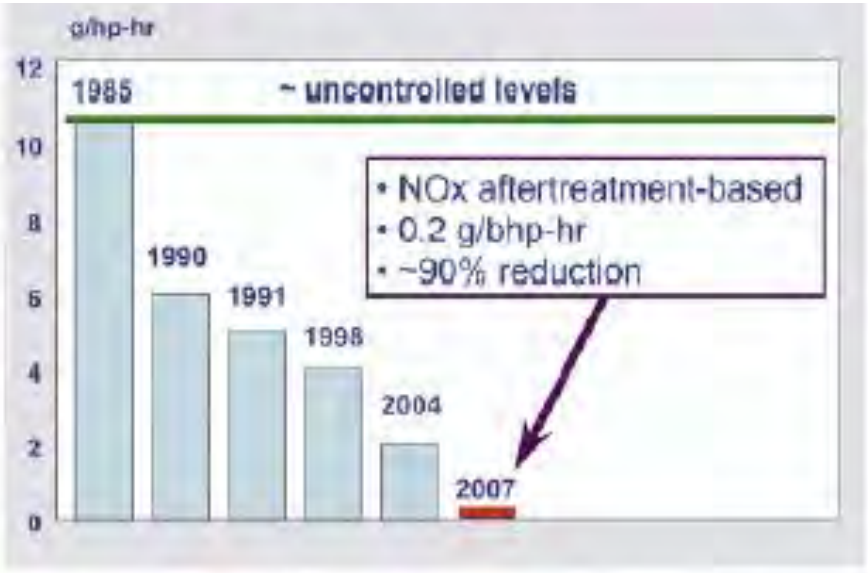
8.12.1 Cleantech takes existing technology and adds layers of control and cleaning

This Cleantech approach takes outdated, inefficient, polluting technology and with the application of advanced computer control and some addition of cleaning technologies produces services with less emissions more efficiently.

8.12.2 Example: Diesel engine

Advanced computer control of the combustion of the diesel engine, combined with advances in particle filtration have transformed this once dirty and environmentally detrimental technology to an efficient, clean transportation solution. This new development is called Control Engineering. Control engineering is the engineering discipline that focuses on the modeling of a diverse range of dynamic systems (e.g. mechanical systems) and the design of controllers that will cause these systems to behave in the desired manner.

2007: Highway Diesel NOx Standards



For model year 2007, NOx emission standards for heavyduty engines are reduced over 90% of current standards.

8.12.3 Advantages: reduced need for new infrastructure

This is, then one of the promises of cleantech: to take existing technology and build a control and cleaning layer to make it perform to modern standards.

8.12.4 Maintain economic stability

This approach has the benefit of being relatively fast compared to scrapping and replacing existing technology. It also creates more economic stability, reducing the need for firms to raise capital for new infrastructure throughout supply chains. Diesel technology has been successful in reducing NOx. Diagram courtesy of the United States Environmental Protection Agency.

8.12.5 Comparison between Economy and diesel engine

Most economic instruments and regulatory mechanisms used today, with the exception of electronic trading, originate back to the period before ubiquitous computing, global supply chains and awareness of risks of externalized emissions costs.

The table below illustrates the opportunities afforded by modern technology for applying fees and changing them to adapt to conditions.

Then	Now
• Paper document based trading, with long lead times for accounting • Minimum of statistics • Long and slow methods of communication (e.g. surface post) • Labourious calculations required	• Computerised trading and tax system • Multiple statistics collection points • Fast communication • Calculations can be handled by modern computer technology

Application to political economics means applying control approaches to supply and value chains containing pollutants. More specifically, as combustion is controlled by the millisecond depending on conditions in the piston chamber, emissions can be controlled in real time by a variable fee depending on the behavior of these supply and value chains and the markets, including financial markets, that influence them. At the same time, the fee is not just to be seen as a cost, but a revenue into the economy. This revenue stream can also be harnessed to drive sustainable development.

This would simultaneously eliminate a major systemic error by creating an incentive structure, in the economic system, which is beneficial for stable, sustainable development.

8.13 Description of Höglund's fee mechanism

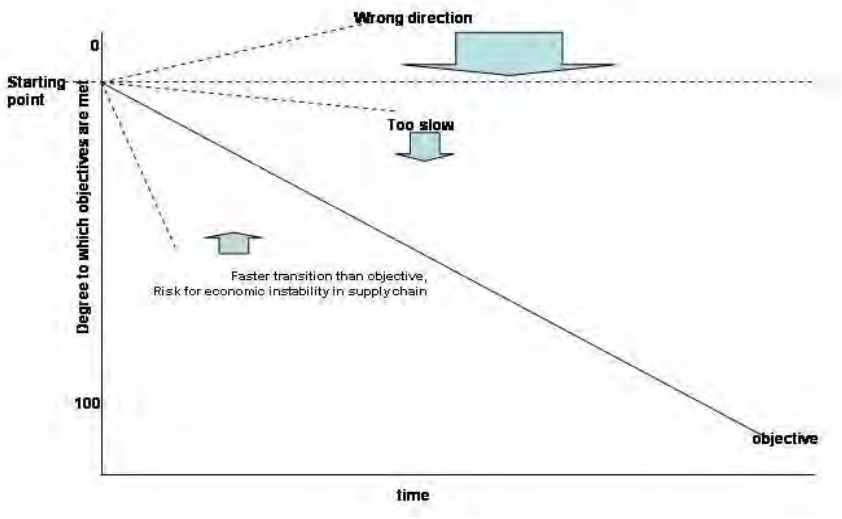
8.13.1 Basic concept

An emissions fee scheme is set up for substances that government goals call for reduction or elimination of their release into the public waste stream or environment. The size of the fee will be increased if sales and emissions increase, and decreased if the rate of reduction is faster than the objective. If the fee is *sufficiently* high, and if there is market uncertainty as to how large the next fee will be, market forces will work to change the behavior of supply chains[127].

The market will react based on a wide range of factors, including availability of futures markets to hedge the cost of fees, as well as availability of technology and methodology to eliminate emissions.

The fee mechanism allows for the revenue collected to be redirected to firms, for example to introduce cleantech.

Fees can change the speed and direction of development



The size of the fee depends on the behavior of the market. The larger the gap between objective and actual, the larger the fee (blue arrow)

[127] A thorough theoretical analysis of Höglund's mechanism has been carried out by IVL, The Swedish Environmtental Research Institute. The report may be downloaded from http://tiny.cc/F6Dxl

8.13.2 Main actors

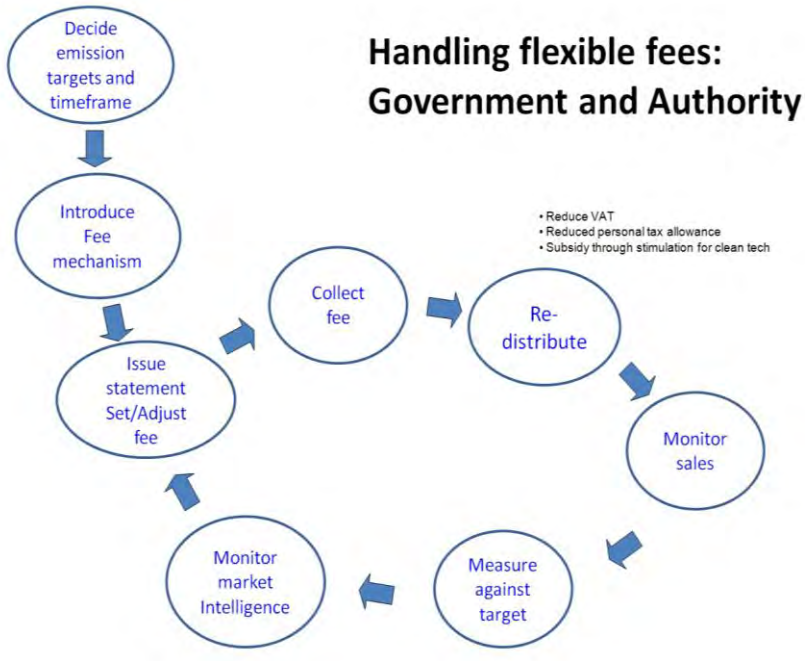
- The government agency that is responsible for monitoring emission levels and setting and collecting feed
- An importer or producer of an emission causing substance
- The end users of the substance
- Suppliers of clean tech
- Market makers in financial markets (options market and options brokers)

8.13.3 Main components

The Höglund approach consists of six main components:

- Identification of a traded substance that gives rise to harmful emissions from its use in supply chains
- A reasonable objective for rate of emissions reduction, set by government
- A pollution fee levy mechanism as far back in the supply chain as practicable
- A price setting authority that can monitor fees closely in time and change the fee level regularly
- A mechanism for returning fees back to stimulate commerce, for example, a monthly payment into citizen's tax accounts, effectively giving them more in their pocket to spend after taxes
- Opportunity for a futures market to arise spontaneously

8.13.4 How it works



Decide emission targets and timeframe
The first step is to agree on priorities for the target in terms of the size of reduction and the timeframe. Criteria may include the impact of harmful effects on the environment and the economy, ease of introducing fee levy mechanisms, political expediency etc.

Introduce fee mechanism
Exactly how the fee could be levied needs to be worked out – many factors can play in including the effects on cross border trade. Redistribution needs to be considered at this stage – what will the monies be used for and how will they stimulate the desired behaviour of the system?

Issue statement and set/adjust fee
The government announces it will introduce a flexible fee system and give actors time to prepare.

This announcement will create an uncertainty in the market. They will be presented with some major choices including:

- Continue using the substance and introduce a margin in their business plans to pay the fee (i.e. increase prices to pass on costs to end users)
- Plan to invest in cleantech to reduce or remove emissions
- Plan to invest in non fee-incurring alternatives

Choices will depend on the willingness of their customers to absorb the costs involved, the price and availability of clearer alternatives and the time frame within which the alternatives can be introduced.
The size of the fee will affect the decision. If it is cheaper to pay the fee, the firm may decide to continue as usual.

Introduction of fee, collection and monitoring
At regular intervals the government monitors the amount of fee collected as well as levels of emissions.

Redistribution of fee
Redistribution, or feedback, is the other cycle of control engineering applied to the behavior of the economy. Redistribution can stimulate consumption, investment in new technology or attractiveness of a certain product or service**.**

Monitor sales
An agreed and accepted method of monitoring sales needs to be introduced and used.

Measure against target
Sales of the substance need to be interpreted against target. This may require some estimations as many factors including seasonality, amounts of stock kept, etc will play in**.**

Monitor market intelligence
Sales may not give the full picture on use of emission-causing substances. As fee levels will affect profitability, it is likely that the financial industry will start to analyze, speculate and offer insurance instruments etc. These activities will also provide a great deal of intelligence on which to base the decision to adjust fees in the next period.

Adjust fee
If levels of emissions do not fall despite fee introduction, the fee is not affecting the market. If monitoring indicates no change, the fee is adjusted upwards. This continues until emissions fall.

If the fee is so high it creates economic instability and disruption in supply chains, an adjustment downwards is made. If emissions are falling according to objectives, fees remain at previous levels.

A market for futures[128] may arise in order to create some kind of insurance for the supply chain actors. In this case, the futures market will also present the government with a measure of the rate of change the market can handle. Another benefit of a futures market arising is that it focuses the attention of the market onto salient aspects of emissions handling like introduction of new technology, its efficacy, investment needs and the performance of the industry compared to government goals. For a more detailed explanation of the mechanism, see the appendix.

As the fees create a revenue stream, governments can or stimulate and reward reduction of emissions and adoption of new technology with grants and subsidies. New technology will come into the market faster in this way.

Issue statement
Depending on market behavior, the government authority can issue statements to further encourage market action.

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[128] In finance, a futures contract is a standardized contract, traded on a futures exchange, to buy or sell a specified commodity of standardized quality (which, in many cases, may be such non-traditional "commodities" as foreign currencies, commercial or government paper [e.g., bonds], or "baskets" of corporate equity ["stock indices"] or other financial instruments) at a certain date in the future, at a price (the futures price) determined by the instantaneous equilibrium between the forces of supply and demand among competing buy and sell orders on the exchange at the time of the purchase or sale of the contract. Source: Wikipedia.org.

Constructing the fee mechanism

The fee mechanism should fit existing business, regulatory and fiscal practices as far as possible to reduce implementation costs. System barriers should represent already established regulatory points. Examples of these include import duties, mining and other extraction fees.

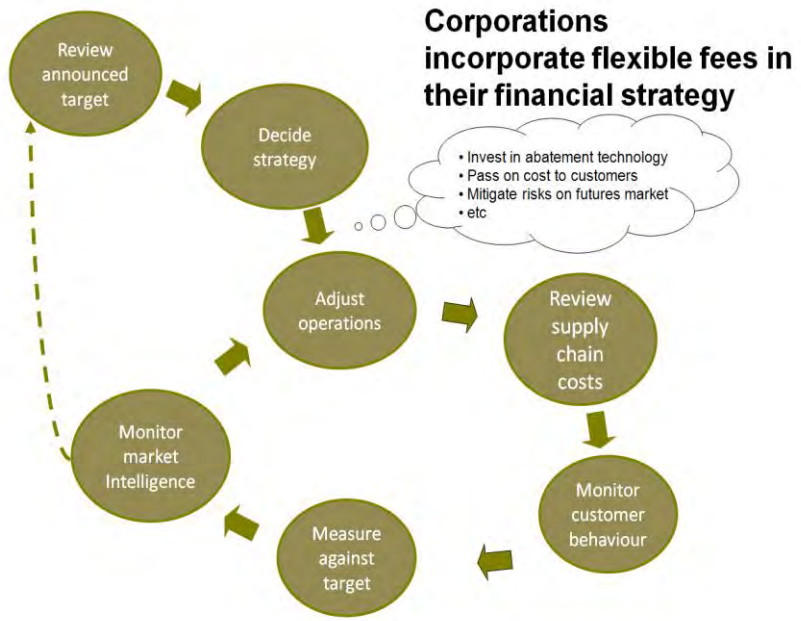
Agencies should also work to place fees as early in the supply chain as possible, again to reduce costs for implementation. This is because *extraction or production* of substances that give rise to pollution often have fewer producers than end users. Another advantage of early fee application is that it brings the substance under control before it enters the myriad of streams in the supply chain.

Constructing the redistribution mechanism

It is important to bear in mind that seen from a national level a fee on a substance that is detrimental to emit does not affect GDP or cause inflation. What does negatively affect GDP is the loss of jobs from a reduction in consumer spending.

Not all consumer spending needs to be seen as driving environmental degradation. When consumers share their wealth by supporting cultural events, sporting events, and social gatherings for example, the emissions can be relatively low and the employment opportunities generated high.

8.14 How flexible fees affect corporations in the supply chain



The diagram above explains how corporations might respond to the introduction of emissions targets coupled to a flexible emissions fee scheme. Firms will need to review the announcement and decide strategy. It may be that they can respond easily if alternatives are available – or it may require major changes in strategy and technology – with massive investments. They will need to monitor customer behavior and glean market intelligence to inform their strategy.

8.15 The case for a transition account for all

One essential component of the Höglund approach is redistribution of the fees. In its simplest form, the approach implies a "tax break" for every registered tax payer. Each person's tax account could be credited, effectively leaving more in their pocket from their monthly wages. The tax break could be based on percentage of earnings, but a flat sum, the same for everyone, would have the greatest control effect. To understand why this so it is important to consider its basis.

The fee is collected from market actors who are using common resources in a way that must stop. As a transition from polluting and/or resource depleting behavior to more appropriate behavior is implied, the account is money that can be used to stimulate, through consumer behavior, a transition.

Of course, a consumer who pays a lot of money for, say, a charter trip by air the Thailand from Europe could take the money in her transition account and use it for one more trip. However, not only will the price be rising if the emissions are not falling at the target rate, but the fee paid will be going to others' accounts to stimulate their spending and market forces will be offering compelling alternative holidays.

The other argument for a "transition account" is that it immediately encourages guilt-free consumer spending: each purchase is either adding to the transition fund or encouraging clean supply chain behavior.

Finally, a transition account drives employment. As consumers get money into their accounts they will be tempted to spend it. As emission-producing services get more expensive, greener services -and likely more labour-intensive ones at that – become more competitive.

8.16 Worked examples

8.16.1 Phosphorus

Phosphorus is finite and like oil it will peak sooner or later. In his frightening book *Eating Fossil Fuels* [129] Dale Allen Pfeiffer shows that conventional agriculture is as oil-addicted as the rest of society. A decline in oil production raises questions about how we will feed ourselves.

In the same way, agriculture is addicted to mined phosphates [130]and would be threatened by a peak in phosphate production. As the U.S. Geological Survey (USGS) wrote in summary on phosphates (PDF) [131]:

There are no substitutes for phosphorus in agriculture.

Fortunately, phosphorus – unlike oil – can be recycled. Responses to a phosphorus peak include re-creating a cycle of nutrients, for example, returning animal (including human) manure to cultivated soil as Asian people have done in the not-so-distant past.[132]

As can be seen in the diagram below, phosphorus enters the supply chain in most countries through import as it is mined in just three main places. Phosphorus is an essential component of fertilizer and is applied in agriculture. Some leaks into the surface water and into rivers and eventually into the sea. Once in the sea it is difficult to recover and return to agriculture. It remains in the supply chain in food until it is excreted as urine and taken care of by sewage treatment plants. Inevitably, phosphorus leaks into the sea stimulating among other things algal blooming. This problem is especially prevalent in the Baltic Sea area, creating problems for the fishing industry and damaging the tourist industry by closing beaches.

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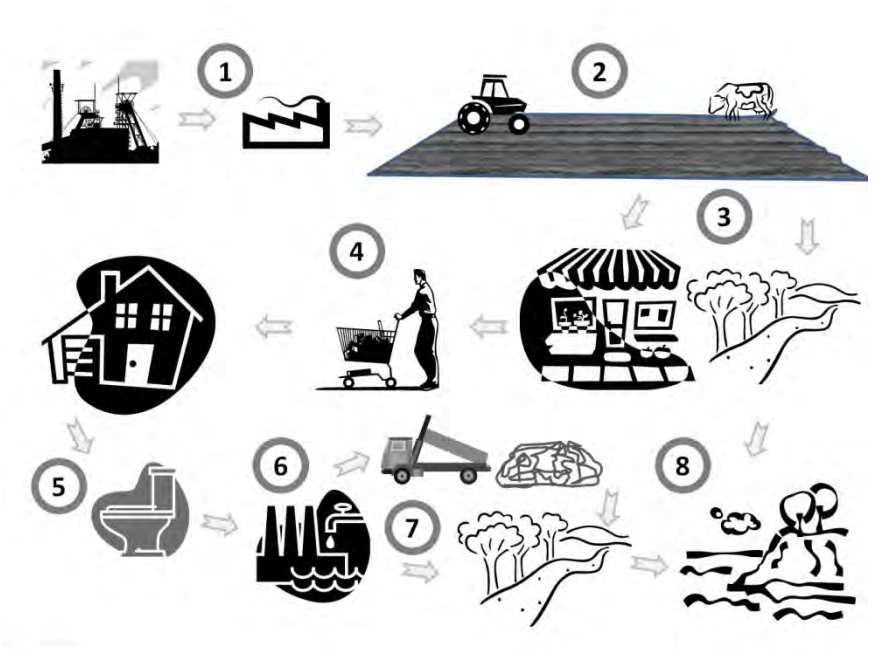
[129] http://www.amazon.com/Eating-Fossil-Fuels-Coming-Agriculture/dp/0865715653.

[130] Abelson, Philip H. "A Potential Phosphate Crisis." *Science*. 26 March 1999: Vol. 283. no. 5410, p. 2015.

[131] http://minerals.usgs.gov/minerals/pubs/commodity/phosphate_rock/phospmcs07.pdf.

[132] F.H. King. *Farmers of Forty Centuries: Organic Farming in China, Korea and Japan* , Dover Publications, NY, 1911 (ed. 2004).



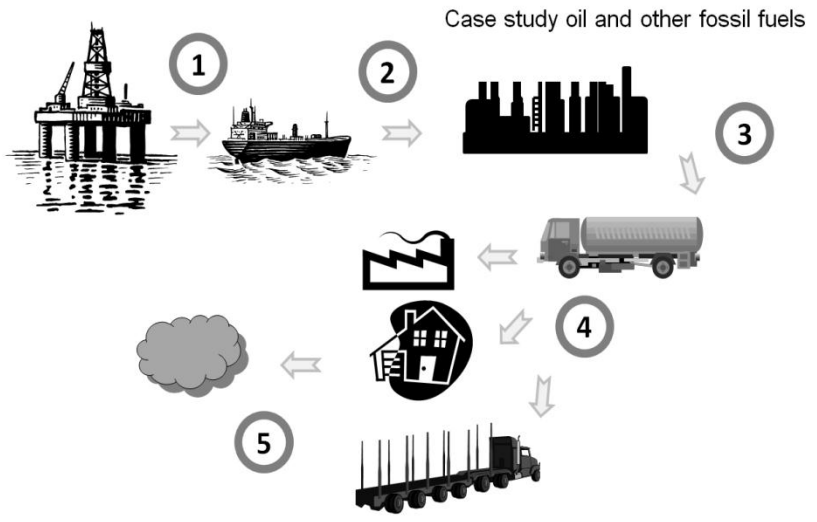
1. Phosphorus is mined and processed into fertilizer along with other nutrients like potassium and nitrogen
2. Applied to the fields, it is incorporated into vegetables and sold direct or into animal feed
3. Phosphorus leaks from agriculture into waterways and is exported to shops as food
4. Consumers purchase food for consumption
5. Phosphorus leaves the body mainly as urine
6. Sewage is processed at water purification plants
7. Some phosphorus is dumped as waste from purification, some ends up in waterways
8. Eventually phosphorus travels to the sea where it is in principle unrecoverable

As phosphorus supplies are finite, it would be beneficial to the national economy to encourage recycling – lack of supply will cause food price hikes. It would also reduce damages to waterways and sea ecology.

The Höglund approach could look like this applied to the phosphorus case:

Identify system boundaries:	Entry: import of phosphorus in fertilizer and as minerals as well as in food. Exit: release from water treatment plants, leakage from agriculture, release from homes not connected to sewer system.
Plan reasonable phase-out of emissions over time:	Some of the issues that might inform the decision: small amounts of leakage may be tolerable from a waterway ecology viewpoint. On the other hand, dependency should be cut to protect long term viability of the food industry. The technology for recycling phosphorus is widely available. Based on this a zero emissions target could be achieved in say 30 years, with the aim to reduce emission by half within ten.
Set up fee mechanism:	Initially, a fee charged bimonthly on imports of phosphorous-containing compounds for agricultural use. Factors to consider include imported food contains phosphorus – and so does exported food, factors to consider.
Set up redistribution:	Issues for consideration: As food price stability is central to the transformation, redistributing the money via general alleviation of personal taxes could be brought about. More disposable income gives more money to spend on food. The current sewage infrastructure stems from designs of the 1800s. Massive investments are needed to enable phosphorus recycling. Some fee income could be used to stimulate development in this area.
Monitor market behavior:	Things to look for: that the fee is sufficiently high to encourage firms with low abatement costs to change operations. Areas where abatement costs appear prohibitive. Monitoring import of food and other ways for phosphorus to enter the country and affect the competitiveness of home grown food. Making sure food prices do not affect inflation.

Carbon Dioxide



1. Oil is extracted on land or at sea
2. It is transported to refineries
3. From the refinery, oil products such as heating oil, and diesel and petrol are distributed into supply chains
4. Most oil is combusted although some percentage of carbon remains trapped in plastics, paints, adhesives, etc
5. Carbon from the extracted oil ends up as carbon dioxide as a result of combustion

The Höglund approach could look like this applied to the carbon dioxide case.

Identify system boundaries:	**Entry:** import of fossil fuels or extraction in country. **Exit:** as carbon dioxide as result of combustion.
Plan reasonable phase-out of emissions over time:	Some of the issues that might be considered: fossil fuels are needed to grow the economy given the present system. No replacement for liquid fuels is close. Climate scientists call for return to 350 ppm CO2 in atmosphere, this would require a fast phase out.
Set up fee mechanism:	Initially, perhaps a fee charged bimonthly on imports/extraction of fossil fuel.
Set up redistribution:	**Issues for consideration**: promoting low carbon economy, renewable energy sources and energy efficiency would be helpful. Food, water and housing security would lay foundations for prosperity.
Monitor market behavior:	Things to look for: economic activity remains acceptable, imports reduce at target rate, no import of carbon via other nation's emissions.

8.17 Benefits of the Höglund mechanism

8.17.1 Competitively neutral

The fee-setting mechanism is based on what the market can handle. The advantage of this is that the fee does not offer competitive advantages to one actor or another, but rather encourages the free market to dominate within accepted rates of reduction of externalization.

8.17.2 Can react to price changes

Should prices rise suddenly, as a result of production shortfalls, for example, sales and emissions targets could well be met as a result. In this case, as targets are being met, the fee could be reduced. This will ease the burden of the price shock on companies in the supply chain.

8.17.3 Uses tried and tested components

The Höglund approach uses components that are already I place. For example, variable fees and taxes are used for differential VAT. Congestion charges are levied depending on time of day. Sweden and a few other countries already levy carbon dioxide fees on fuel.

Using already existing mechanisms means the costs for the introduction of flexible emission fees can be kept low.

8.17.4 UNCERTAINTY stimulates market actor's attention

Because the uncertainty generated by the fee system will cause futures market to arise, there will be greater attention on the economic consequences of emission. This is good because the greater information

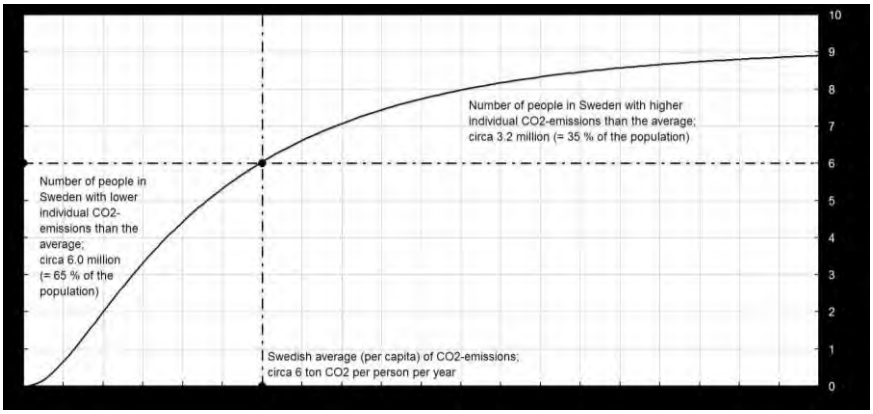
spread will create more awareness of the issues involves and greater willingness to invest in these areas.

8.17.5 Politically expedient

Because the fee is set in effect by market forces, the level of political involvement is restricted to creating agreed emission targets and introducing the mechanism. This relieves politicians from having to get involved in the dichotomy between preserving ecological services, health, and natural resources versus the demand for citizens for economic growth. It makes it possible therefore for politicians to work towards sustainable development.

8.17.6 affects those who can afford to pay

Analysis reveals that a major percentage of emissions are actually caused by a minority of the population; those with the best incomes. Because the fee is passed on to the end consumer, it will be the best paid members of society – those who can best afford it – who will be affected by higher costs. This means the mechanism can be seen as being fair in its approach. (See diagram below.)



The top 35% of the wealthy in Sweden are also the largest polluters Source; Höglund

8.17.7 Stimulates the economy to grow in a positive direction

As pointed out earlier, economic growth in itself is not purely a measure of human progress. As all spending is reflected in the figure, costs negative to society are reflected too, like spending associated with natural disasters, crimes, and polluting industries.

By taking money out of the economy from polluters, and giving it to consumers to spend, a virtuous cycle is created where more and more "appropriate" services are demanded and become relatively cheaper. If,

for example, fuel prices soar due to fee increases, and consumers get more in their pockets to spend, we would likely see an increase in demand for rail travel on lines electrified by hydro power.

To summarize; global economic growth and development can be made benign and sustainable by proper use of economic feedback control. The economic feedback control proposed here can be designed to benefit the majority of the population in addition to being efficient, objective and fair in treating all emissions and emitters the same.

8.17.8 Removes the guilt from spending

Many consumers feel guilty because it is clear to them that their life style results in emissions that will affect future generations. At the same time they are torn between the feeling of guilt and the responsibility they feel towards their families and the perceived lack of choice.

The introduction of flexible fees means that consumers who, for example, choose to fly long distance, will in effect be paying for society to address the problem and transition away from the practice. They can see their flight as an investment in less polluting alternatives.

In the same way, consumers are worried about spending, because unemployment is high and the outlook appears bleak. Flexible fee mechanisms put money in consumers' pockets, creating demand for services and thereby employment. Knowing these mechanisms are in place will encourage consumers to redirect their money into the economy.

8.18 Q&A

Surely emissions fees have been tried before- what is different about the Höglund mechanism?

Emission fees have been applied it is true. Sweden has a Carbon Dioxide tax on petrol. What is different (and not been tried) is that Höglund's fee is flexible and carries with it uncertainty. If emissions do not go down, despite fees, fees are raised for example. If they go down too quickly, there is possibly detrimental effects on the economy, so they can be adjusted downwards. Although flexible fees have been introduced in airline seats for example, they have not been tried for emissions.

Will it not be difficult to impose a flexible fee?

Flexible payment mechanisms are actually widespread. For example, congestion charges vary depending on time of day. The Stockholm congestion charge is paid to both leave and enter the city, and charged using a number plate recognition system and a separate account that is direct debited. Most Stockholmers with cars hardly notice the economic activity incurred from travelling in and out of the city.

Petrol filling stations nowadays have digital price boards to cope with constant price changes.

Will redistribution be difficult?

Redistribution mechanisms exist that can be used. The *Alaska resident payment system* – the permanent fund dividend redistributes money from oil extraction.[133]

Many tax systems include a base amount of income that is untaxed. Raising this level is effectively redistribution.

Subsidies are well-known redistribution mechanisms.

Surely, tough restrictions at home will destroy companies' competitiveness with foreign firms at home and abroad

It is true that applying an emissions tax in one country could favor importers. For example, manufacturing of a car can take as much oil (and create carbon dioxide emissions) as the car uses as fuel in its lifetime. A car manufactured in another country and imported will be comparatively cheaper then, as its manufacturing costs are lower.

This illustrates some important points:

1. A sustainable approach to economy works best on a regional or global level
2. A country introducing flexible emissions fees would do best to concentrate on areas where imports from countries with fewer restrictions created a problem for national producers
3. The fees collected should be used wisely. For example, subsidies on green vehicles could favor home manufacturers even against importers
4. Emissions fees are applied to substances entering the country, and are thereby neutral to competition. Exporters will not be affected if they do not emit pollutants in their home country

8.19 Call To Action: Pilots And Demonstrations

The Foundation strongly advises nations to consider the introduction of flexible pollution fees. Experience shows that more information about the fees, the mechanism, about how markets affect the supply chain and futures markets are needed by decision makers before they are able to commit to the introduction of such mechanisms.

The foundation has developed several simulations which can be run as a business game, to expand understanding of the subject area.

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[133] See http://www.pfd.state.ak.us/historical/index.aspx.

The Foundation recommends also the setting up demonstration, or pilot schemes, to allow decision makers to study the implications and mechanisms of this approach. The Foundation is willing to provide their expert assistance for this.

8.19.1 Appendix

More on mechanisms of pricing emissions fees

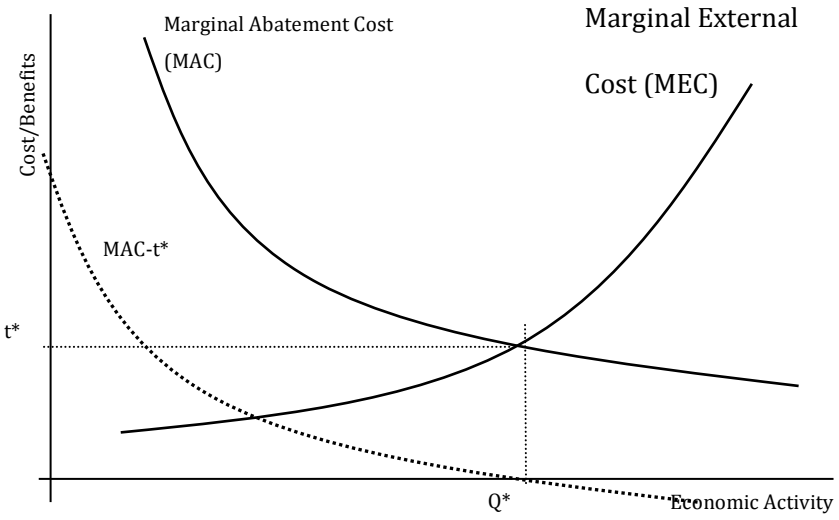
The figure below shows the intersection of a Marginal Abatement Cost (MAC) curve and a Marginal External Cost (MEC). It illustrates the effect of a static pollution fee on levels of pollution, assuming perfect competition. By imposing an optimal fee of t*, the level of pollution is reduced from some level Q (which would be where the MAC curve crosses the horizontal axis) to an optimal level Q*. Similarly, a quantity constraint would fix the cost of pollution such that Q* is reached. Approaching the pollution issue from this perspective, the challenge for policy makers becomes formulating policy which arrives at a fee level that approaches t*, or a quantity constraint that approaches Q*.

It is, in many cases, difficult to identify a reliable MEC curve, particularly with longer-term environmental issues such as climate change. In the case of the climate debate for example, substantial resources have been devoted towards developing a better understanding of the MEC. The International Panel on Climate Change and their assessment reports are an example of the steps that are being taken.

MAC curves on the other hand have been derived either using a "top down" or a "bottom up" methodology. Top-down curves are derived from economic models. These are generally produced from Computable General Equilibrium (CGE or GEM) models. Such curves cannot distinguish accurately which sectors or technologies produce abatement and are dependent on the extrapolation of past trends when deriving their curves. On the other hand, bottom up curves are derived from engineering studies and technology assessments. Such curves exhibit good detail but often have gaps in one or more sectors due to a lack of data and do not include feedback effects on other economic variables of investing in certain options.[134] Deriving the MAC curve is difficult for a variety of reasons, commercial confidentiality being another important example.

[134] Ellermann et al. (1998).

Optimal pollution level Q*



Indeed, many economist consider that the government is in a poor position to extract this information and some even go so far as to argue that the existence of this information asymmetry is enough to preclude government intervention.[135]

In this regard, environmental policy faces a considerable challenge. On the one hand, the MEC curve must be known to some degree. The less that is known about the result of pollution damages, obviously, the more difficult it is to formulate an effective policy. On the other hand, the MAC curve must also be known to some degree. The less that is known about the MAC curve, the harder it is to formulate an effective policy. Without the certainty of reliable MAC and MEC curves, there is the risk that the policy will overshoot or undershoot what is economically or environmentally optimal.

The flexible pollution fee would allow firms to act on an open market based on the information they have about their own abatement costs. By hedging their abatement investments (or even hedging their decision not to invest), a level of the pollution fee is established. The fee level would, in the long run, be a function of an aggregate MAC of those firms that participate on the market and the life of their abatement investments.

From the NUTEK report "A flexible pollution tax."

[135] Pearce and Turner (1990).

8.19.2 About Anders Höglund

Anders Höglund is an engine researcher and part owner of Swedish-based Cargine Engineering. Anders worked for VOLVO for 26 years as a combustion engine developer. He started to develop his ideas on flexible emission fees in 1988 when he realized that modern control technology approaches, among other things used to make diesel engines clean, can be applied to modern economies. He has been a member of the Board since its foundation in 1995.

8.19.3 About the Author

Stephen Hinton, BSc, Cert Ed started teaching science after completing his studies at the University of London, Institute of Education. Moving into management consulting and then a career in Telecoms during the 90s, he continued to explore sustainable development and the power of innovation. In researching for his book, "Inventing for the Sustainable Planet" he realized that new, sustainable, paradigms were urgently needed. He headed the sustainable drinking water company, Purity, 2006–2008. Currently, he is working to establish new forms of sustainable settlements, called Eco-units and is managing the Humanitarian Water and Food Award, based in Copenhagen. Recognizing his wide range of experience in industry, and his knowledge of sustainable development, Stephen was invited to join the Board of the Foundation in 2007.

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9. Appendix 3

9.1 A new method to reduce the emissions of greenhouse gases

By *Anders L Höglund* The Swedish Sustainable Economy Foundation

Abstract
Market prices can serve as efficient signals of resource costs in complex economic systems. However, a necessary condition for long-term sustainability is that the cost of externalities is internalized in the economy.

With prices including sufficiently high fees on emissions of, for example, greenhouse gases it is possible to achieve a control function in the economy which can reduce the emissions of greenhouse gases to a long-term sustainable level.

This paper describes a method to "reveal" the cost of reducing harmful emissions and to allocate the emissions reduction so that societal cost efficiency is achieved not only spatially but also temporally.

The method can be applied nationally as well as internationally. For obvious reasons the best result is achieved if the method is applied globally.

The method has the advantage that the long proven and efficient system of the Swedish CO2-fee can be retained and further developed. The method may serve as a complement to the European Emissions Trading Scheme for the sectors outside the trade system.

Content

9.2 Introduction

In most cases it is difficult to evaluate the long-term societal economic costs which have been and which will be caused by pollutant emissions. The fact that the alternative costs for the pollutant emissions also vary both in time and in space makes the evaluation extremely uncertain. Uncertainty about real costs and the lack of concrete prices will in turn

cause uncertainty in economic decisions. The result is that vital, long-term sustainable, investments are withheld or become severely delayed due to lack of incentive.

However, there exists a simple and general principle for the evaluation of a "clean environment". The principle is to let the average alternative cost to avoid pollutant emissions determine a fee which is levied on the emissions.

A fee on emissions, which reflects the average cost of emissions reduction, will give firms, with higher abatement costs than the average, a time span, in other words an opportunity to a well planned adjustment or liquidation to the smallest possible cost and/or the smallest possible capital destruction, and firms with lower abatement costs than the average, a sufficient incentive to reduce their emissions.

This means that the "practically impossible" task of evaluating the total societal cost of millions of individual emissions, can be reduced to the "manageable" task of finding the average cost of emissions reduction.

The simplified task to find the average cost can be solved by the use of an efficient and well proven instrument – a futures market.

9.2.1 A new market economic method

Here a new market economic method to internalize costs is described.

If the emission fee for a certain substance is much higher than the cost of emissions reduction this will, of course, result in a swift reduction of the emissions of this substance, which could be very beneficial for the environment, but there is a risk that the environmental improvement is accompanied by a societal economic loss which is greater than the environmental gain. This could happen through capital destruction due to a premature shut-down and scrapping of well functioning plants, machinery, processes, etc.

On the other hand, if the fee is much lower than the cost of emissions reduction the emissions will continue which could result in even higher societal economic costs. Somewhere in between these extremities there is an emission level which is the optimum for the achievement of economic efficiency in the development towards a long-term sustainable system.

From the reasoning above the conclusion is that the needed emission fee for societal cost efficiency can be expected to be strongly correlated to the average cost of emissions abatement.

A futures market is primarily a price and cost insurance market and as such it elicits a price and cost revealing behavior of the actors. Therefore it is feasible to utilize a futures market to find the wanted optimal level of the emission fee.

The trade in emissions fee futures contract on an Emissions Fee Futures Market can function according to the same principles as the trade in futures contract on a Commodities Futures Market. This form of trade

has proven to be able to provide good liquidity and low transaction costs – essential conditions for efficient resource allocation. The rules and regulations since long established on the futures markets can be directly applied on the Emissions Fee Futures Market.

When an Emissions Fee Futures Market has been established firms and individual actors can include the known future cost of emissions in their budgets and without unnecessary risk taking invest in long-term emissions reducing measures. Their individual actions on the emissions fee futures market will reveal the average cost of emissions abatement.

The following terms are valid for the emissions fee futures contract:

A. The Futures Contract is a binding agreement between buyer and seller about the delivery of the emission 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 the agreement
B. By delivery is meant a simple clearing procedure on the day when the contract expires

By utilizing the two, above stated, conditions for the futures contracts, the buyer and the seller can trade the cost of future emission fees.

From a trade technical aspect the emissions fee futures contracts are identical to "common" futures contracts of the same type as are traded on the commodities market COMEX in New York. Emissions fee options that are options on emissions fee futures are in all aspects identical to "common" options.

Those actors finding it cheaper to reduce their emissions than to pay the current future emission fee (the price of the contract on the market), will be willing to sell contracts to reduce their risk. Those finding it cheaper to pay the emission fee will be willing to buy contracts for the same reason. Of course there is also room for speculators whose activities, for the most part, can reduce fundamental errors in the pricing of the contracts and increase the liquidity on the market. Since the emission fees, in a suggested scenario, has to be paid to the IRS every month the necessary basic conditions for a functioning futures market are fulfilled.

On the expiry date the contracts are cleared between sellers and buyers based on the difference of the contracted price and the expiry price.

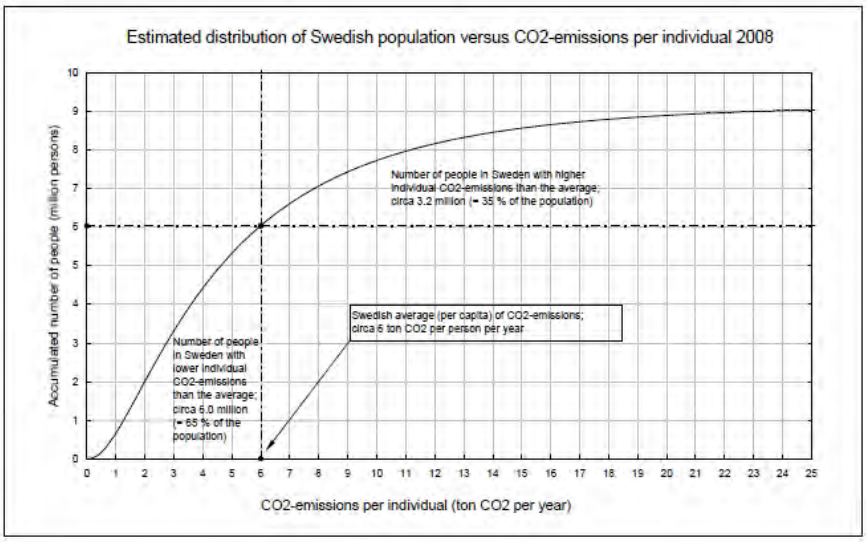
During each emission fee period all registered firms pay the emission fee determined by the market on the expiry date. This principle is general and valid irrespective of the actions of firms and other actors on the market and independent of the number of contracts bought or sold. The advantage of this is that the present Swedish rules and regulations concerning the CO2-emission fee on fossil fuels can be continued without any change.

The function of the emissions fee futures market is to provide a sufficient number of contracts for a certain time period to enable an actor, whom so desires, to freeze the cost, at the current cost for the emissions

fee futures contract, for emissions during the same time period. Although the final, and different, emission fee, for the time period is paid, the trade on the futures market will generate a gain or a loss exactly covering the difference in the emission fee cost.

The opportunity to freeze future costs for emissions, through trade on the emissions fee futures market, can create an investment climate favoring longterm environmentally compatible investments.

Figure 1.



Source: Anders Höglund

A closer analysis of figure 1, showing a hypothetical distribution of the population as a function of the amount of emissions per individual, reveals that circa two thirds of the population in Sweden would benefit from a CO2-fee which was repaid in equal shares to all, since there are a greater number of individuals with emissions below than above the average amount of emissions per person.

Another way of expressing the same thing is to state that there is always, in all emissions distributions, a tail stretching upwards in the amount per individual. A tail moving the average amount of emissions upward since there is a lower bound at zero emissions.

In some developing countries the resource and emissions distribution is so uneven that more than four fifths of the population would benefit from a CO2-fee if the income from the fee was repaid in equal shares to all. Such redistribution will favor those with little resources, who through the redistribution will gain access to more resources and greater purchasing power. This redistribution is societal beneficial. Although those with an abundance of resources are disfavored they have both the freedom and the means to change their consumption pattern so that they also become

favored. Of course this is exactly this change in the consumption pattern which is the whole point of introducing emission fees.

The fact that such a redistribution of emission fees will always favor the majority of the population will of course simplify the introduction of sufficiently high emission fees by democratic means. Observe that fully repaid emission fees are budget neutral.

Standardized emission fee futures contracts

An example of information in a standardized emission fee futures contract:

1. Underlying asset: The emission fee for the specified substance, in the specified amount, during the specified time period
2. Substance: Carbon dioxide, CO2
3. Amount:1 000 kg
4. Fee time period: Month of May 2012
5. Date of expiry: Last trading day in April 2012
6. Conditions:
    a) The futures contract is a binding agreement between the buyer and the seller where the seller is bound to deliver the underlying asset to the agreed price at the expiry date
    b) With a delivery is here meant a clearing operation on the expiry date of the futures contract

The level of the emission fee

An important aspect for the balance on the emissions fee futures market is that it is profitable to sell contracts when the alternative cost to reduce the emissions is lower than the price on the market and to buy contracts when the alternative cost is higher than the market price.

Without the opportunity to secure the emissions abating investments, firms investing in new and cleaner technology or alternative measures risk being outcompeted by more speculative firms which do not invest and therefore have an advantage in the form of lower costs in case the level of the emission fee falls. The opportunity for firms and private persons to insure against price changes in the emissions fee and to be able to invest and secure their investment is conducive to a societal cost effective resource allocation.

The potential sellers of contracts have emissions whose abatement cost is lower than the emission fee and the potential buyers of contracts have emissions whose abatement cost is higher than the emission fee. These two complementary strategies among the actors on the market contributes in the price of the emissions fee futures contracts being controlled, although with fluctuations, towards the average cost of emissions reduction.

Since the emission fees affect the whole population it is self-evident that the opportunity to trade on the Emissions Fee Futures Market is

open to all actors. It should be possible even for individuals to make private investments without taking unnecessary risks when the price on the market makes that profitable.

An example: It is wise to invest in a heat pump to reduce the use of fossil fuel in a heating system of a building, if the emissions fee is so high that this is profitable. At the same time this would be a risk if there were no opportunity to sell emission fee contracts on the market covering the amount of the emissions reduction from the investment.

The emission fee futures contracts give firms and other actors the possibility to insure against fluctuations in the price of the emission fee.

It is the distribution of costs and risk between actors with different conditions, through a trade in futures contracts, which control the level of the emission fee in the direction towards the optimum in the economy. It is this cost-revealing', market function which is the primary argument for an emissions fee futures market.

An emissions fee futures market can, just as a commodities futures market, function even without speculation and exclusively with actors trading only for the purpose of hedging against price changes. However, some degree of speculative trading can be beneficial for the liquidity of the market.

Beneficial effects from trading on the emissions fee futures market

Apart from the fact that the emissions of environmentally harmful substances will successively be reduced, when emissions reductions, to a cost lower than the emission fees, become profitable, the market also has other beneficial effects.

The emissions fee futures market will reflect the cost for firms to reduce their emissions but the market will also elicit and be affected by analyses of the economic influence of the emission fee on firms and on society.

The emission fees will have to fluctuate, in order to make it possible for the fees to reflect the different and varying costs of the actors and the information about the environmental effects of the emissions which is available and which is constantly changing, deepened and refined.

The emissions fee futures market will, just like a commodities futures market, be exposed to false information. This is necessary in order to maintain the ability of the actors to critical analysis and evaluation of the information which is of relevance for the price of an emission fee. A sterilized' flow of information, free from all misguiding information may have a devastating effect on the "immune system" of the market against disinformation and harmful speculation.

With a functioning emissions fee futures market it will become profitable to invest in research, both wide and deep, resulting in new knowledge which of course will have an influence on the market. This is desirable since the information about and the knowledge about real effects on the environment is the basis for efficient decisions.

It is not only research about the environmental effects of emissions which will be stimulated by an emissions fee futures market but also the research and development of new technologies for emissions reduction and for alternative production methods. This information and development will emerge without the need for lengthy political debate and slow moving bureaucracy. An emissions fee futures market of the type proposed in this paper can be interpreted as a new form of market – it is an immaterial market. And as such it has the potential to internalize harmful externalities and to harmonize private interest with common long term interest and microeconomic actions with macroeconomic action.

The positive potential of this new market is huge. It will in addition relieve the politicians from the democratically impossible task of making the unpopular decisions needed regarding the environmental problems threatening the existence of millions of people.

If the thought of a market control of the price of emissions cannot yet be accepted by the decision makers and the population the emission fee can be set by political decree for as long as is needed. In such a situation an emissions fee futures market will emerge spontaneously and it may serve as an instrument showing the expectation of the direction of the price of emissions.

Most of the beneficial societal effects accompanying the concept of an emissions fee futures market will still be present even if a compromise solution is preferred for some time.

Questions and answers

The emissions fee futures market is based on simple market economic principles but since it is also based on a certain amount of new knowledge there are some objections and questions:

Question 1: A functioning market requires that all who are affected by the market must be able to affect the market price by showing their preferences. How can that happen on the emissions fee futures market?

Answer 1: The claim and the question are based on a misunderstanding about the way a market functions. In the claim there is an implicit demand that the actors should be able to affect or control the price according to their desires and preferences. For example by choosing to act as buyers with the intention to raise the price.

The price of emissions ought not and should not be controlled in such a way since that would mean a totally speculation controlled market. This would violate the basic principles of a free market where supply and demand are controlled by real costs.

It is not the desires of the actors to control or to influence the market which should be the basic price controlling principle on a free market but instead individual decisions about buying or selling based on an analysis of alternative costs.

To a hedger on the market a simple straightforward analysis of the required number of contracts to buy or sell in order to hedge against risk is sufficient.

For a trader the conditions are different and without sufficient knowledge and competence about fundamental price-driving factors the trader will become a loser on the market in the long run.

The commodities futures markets do function although only a small minority of the population are active on those markets. Most people live their life completely unaware of the price movements on the commodities futures markets. Moreover the size of contracts is mostly too large for small scale private hedging. Despite this fact resources are distributed efficiently as a result of the all pervading price signals in a market economy.

Of course, it is also possible to make the size of the contracts on the emissions fee futures market so large that they are beyond the reach of the majority of the population as is the case on the commodities futures markets. But since the emission fees will have a substantial influence on the economy of individuals in the future it could be motivated to make the size of the contracts relatively small. Nobody has to be forced to make deeper economic analyses in a market economy to make rational decisions as long as there are price signals.

Question 2: Who is going to determine the price of the futures contracts of the emission fees and who is going to determine the total amount of emissions and the rate of the emissions reduction?

Answer 2: This question is based on a misunderstanding about the nature of the emissions fee futures market. Who determines the total amount of a certain goods and who determines the price on the same goods? It is best to let supply and demand determine that. Experience shows that large scale planned economies have suffered from severe inefficiency problems and negative side effects.

On the emissions fee futures market the supply and demand will determine the price. This price will affect the total amount of emissions, the distribution of emissions and the rate of emissions reduction.

Since the future is unknown an emissions fee futures market, where the price is allowed to fluctuate freely and where the price of the contracts determine a fee on the emissions, which has to be paid by law, will elicit a behavior of the actors which indirectly show (an average of) their individual costs for emission reduction through their decisions to buy or sell emission fee futures contracts.

The societal optimal emission fee will be found somewhere around the average cost of emissions reduction and the actions of the actors will control the price towards this level.

The price on the market can be interpreted as a weighted average of all available, relevant, varying and often uncertain information. It may at first sight be difficult to accept such an imprecise decision making with such an imperfect system. However, nobody has so far been able to

prove that there exists a more efficient system of evaluation and pricing. Even the most respected experts may differ in their opinion.

The new method described here can also be utilized to radically improve the functioning of many markets such as the stock market and the real estate market. Markets which time and time again are afflicted by a herd behavior of the actors. In practice the method is applied by introducing a fee on the act of buying and where the fee is paid by the buyer to a control fund and after a predetermined time delay the seller will obtain a subsidy from the control fund. This will create a new market with the objective of analyzing and evaluating the primary market.

Question 3: Is it compulsory for all firms with pollutant emissions to buy emission fee futures contract covering the full amount of their emissions?

Answer 3: No the emissions fee futures market is open for all actors but it would be extremely expensive and inefficient to measure the emissions from all individual sources. The most efficient solution is to keep track of fossil carbon by utilizing an "upstream system" where all firms importing or extracting fuels containing fossil carbon are registered. But even though all those firms are required by law to pay a CO2-fee directly in proportion to the amount of fossil carbon sold they will be free to choose if they wish to hedge or trade on the emissions fee futures market.

Question 4: What prevents firms and other actors to push down the market price by selling an arbitrarily large number of contracts when the requirement of physical delivery at the expiry date is not present?

Answer 4: The counteracting forces against unlimited speculation are:

a) The real cost of reducing emissions
b) The margin always required by the market makers and which is proportional to the number of contracts sold. This margin cost is strongly coupled to the real cost of emissions reduction – a powerful brake against speculative dumping of the market price through large scale selling
c) The leverage increasing without limit to the advantage of the buyer when the market price of contracts approaches zero since the buyer can never lose more than the total price paid for the contracts. The potential loss for the seller on the other hand has no upper limit when the market price of contracts is rising
d) The continuous elimination of bankrupt speculators
e) The speculation which over time eliminates all observable systematic price fluctuations and all trends not depending on real fundamental costs
f) The accumulating collective knowledge and experience of the actors
g) The free flow of information which, of course, also can contain the information about the counter forces mentioned here

There is no fundamental difference between the Emissions Fee Futures Market and a Commodities Futures Market. Note that the cash (margin) deposit always required when selling a futures contract will set an absolute upper limit for the maximum number of contracts that can be sold since the total amount of financial capital is limited.

Practically all functions on the Emissions Fee Futures Market are also present on a Commodities Futures Market and practically all objections and questions arising on the subject can be answered by reference to the general rules for futures markets.

Question 5: What prevents the market to be influenced by rumors, false information, etc?

Answer 5: Nothing. It is inadvisable and in a long-term perspective harmful to "protect" the market against disinformation. What is needed is information about the risks coupled to speculation and about the value and the necessity of competent and critical analysis of all market influencing information. In this respect there is no difference between the Emissions Fee Futures Market and an "ordinary" Futures Market.

Question 6: Is it advisable to repay the emission fees to the firms?

Answer 6: It is fundamentally difficult to repay the emission fees due to the difficulty to find an objective principle for such a repayment. Also there is no natural law requiring the income from emission fees to be returned to sectors from which this income has been extracted.

There is a long-term sustainable principle for the evaluation of product utility. This is the decisions by the consumers to buy or not to buy of those products on a free market. Note that this principle, indirectly, results in a repayment of the emission fees to the firms on the condition that their products really are desirable. A conclusion can be drawn that the repayment of the emission fees should be made to the consumers and preferably in equal shares to every individual.

Of course, the incomes from emission fees can also be used, in full or in part to reduce income taxes.

Question 7: Won't the trade on the Emissions Fee Futures Market stop when all the firms have made their hedges to eliminate their risks?

Answer 7: The risk that the trade on the Emissions Fee Futures Market should stop is no more present than the risk that a share on the stock market will not be traded once it has been emitted by a firm or the risk that the trade on a commodities futures market should stop. There will always be a market for hedging of risk irrespective if the risk is coupled to investments or the cost of emissions.

Question 8: Won't the market pricing of pollutant emissions become faulty when the price on the Emissions Fee Futures Market does not have a direct coupling to the real cost for the environmental damage due to the pollutant emissions?

Answer 8: No, the Emissions Fee Futures Market does not exist to put a price on the environmental damage caused by pollutant emissions. The Emissions Fee Futures Market is meant to put a price on the pollutant

emissions so that the underlying causes to the damage can be eliminated in a societal cost efficient way.

The environmental problems do not exist only because our knowledge about the harmful effect is insufficient or because there is a lack of technical means to reduce the emissions. We already know that immediate measures need to be taken. What have been lacking are democratically viable efficient methods with sufficiently strong economic control signals making effective emissions reduction sufficiently profitable.

Question 9: Don't emission fees become far too expensive if the required reduction of emissions is to be achieved? Isn't it better to use a Cap and Trade system to achieve the required reduction of the emissions?

Answer 9: The question is based on a misunderstanding. If the differences in transaction costs and political challenges are ignored the cost to achieve a certain reduction with trade permits is the same as with an emission fee. The total cost of the emission fees is exactly the same as the total cost of the trade permits at a certain total amount of emissions. For a firm in the system it is economically equivalent if an emission fee is paid or if emissions permit is paid for a certain amount of emissions.

However, the differences in transaction costs and the challenge of political implementation clearly favor the emissions fee method. One of the basic features of the Emissions Fee Futures Market is that the fee, set by the market price, should be able to vary in time to be able not only to determine the amount of emissions abatement but also the rate of emissions abatement over time.

In Sweden the efficient and well proven system with a CO2-fee can, with advantage, be retained and improved by allowing more frequent adjustments of the fee.

Question 10: Isn't it true that it will be very expensive to reduce the emissions of greenhouse gases to a long-term sustainable level and that this will have an unacceptable negative influence on the BNP growth rate.

Answer 10: The question is based on an oversimplified and misleading view on the situation. The emission fees, even if they were to amount to several percent of the GNP in the future, are no real costs for society but only a redistribution of financial resources. Furthermore every expense for an emissions abating investment is also an equally large income in the economy. An example: When a firm is making an investment and pays for a new environmentally compliant production facility it is a cost for that particular firm but for the firm or those firms designing, constructing and building the facility this cost will be an income of exactly the same amount covering the expenses for input goods, wages, taxes, interest, fees, et cetera. If the aggregate demand in the economy is optimized, with a sound financial and monetary policy, then no unwanted unemployment needs to occur. There is no reason to let the growth of the GNP be affected negatively through a long-term sustainable devel-

opment. On the contrary the very reason for the emission fees are to maximize the long term beneficial growth of the GNP.

It is also important to realize that a large part of the GNP is, in fact, due to unwanted costs and activities so the idea to always strive for maximum GNP growth will have to be reconsidered in the future.

10. Appendix 4

10.1 Flexible Control Fees with Repayment

10.1.1 Some facts about flexible control fees:

Flexible control fees with a reimbursement mechanism, in other words with repayment, can be seen as a natural extension and development of the well proven Swedish CO2-fee.

Flexible control fees with repayment can be made simple, general and cost efficient and also budget neutral, if so desired. They may also, to a certain degree, be used to strengthen the budget and/or to stimulate the use of new, environmentally compatible and resource conserving technologies.

Flexible control fees can, from their ability to change the price pattern of goods and services, be made to affect the demand pattern in the whole economy so that the use of resources can be controlled and environmental problems eliminated at an optimal rate.

10.1.2 What is the influence of flexible fees on the economy?

By a repayment of a sufficiently large fraction of the revenue from the control fees the majority of the population can receive a repayment which is larger than the extra cost caused by the control fee increasing the price of goods and services.

As a result of the control fees changing the price pattern of goods and services the consumption patter can also be made to change, in the direction of goods and services with less environmental impact and resource consumption. This will reduce the emission of harmful substances and reward consumers for reducing the environmental problems.

Those who can afford to be large scale consumers of goods and services with a large total impact on the environment can also afford, and have the opportunity, to change their behavior in a direction with less impact on the environment by investing and buying products with low control fees so that they end up receiving a larger total repayment than the total amount they have paid in control fees.

10.1.3 Background facts about the Swedish CO2-fee:

Sweden introduced a carbon dioxide fee more than 20 years ago. With a CO2-fee of 1000 SEK per tonne the Swedish CO2-fee is the highest in the world. Swedish companies are competitive despite the high CO2-fee.

10.1.4 A flexible control fee can be implemented in the economy by:

- Designing the repayment of the revenue from the control fees so that the majority of the voters always benefit from the system through an increased purchasing power. This feature of the system makes it possible to reduce the rate of unemployment and to creata political and democratic acceptance of the system
- An important advantage with the repayment of the revenue from the control fees is that it opens the alternative to set a sufficiently high level of the control fees so that the environmental problems can be solved before vital life supporting systems in the environment "flip over", in other words; are strained beyond their ability to recover
- The system with flexible control fees with repayment can become a powerful instrument and tool enabling efficient solutions to local and global environmental and resource problems in the future

11. Appendix 5

11.1 Beneficial Effects from Flexible Control Fees

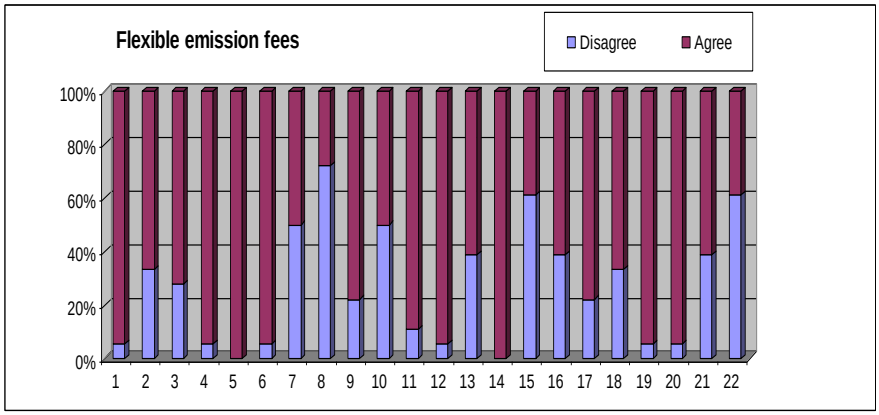
Here is a description of some important economical and psychological signals and beneficial effects which may be the result from flexible control fees.

- An economy complemented with control fees can favor the use of and increase the demand for environmentally compatible and resource conserving technologies
- An increased demand for environmentally compatible and resource conserving technologies can stimulate investment resulting in new employment and production
- The demand for environmentally compatible and resource conserving technologies will result in a demand for a higher level of technology and greater knowledge which in turn can result in a stimulus for Graduate Schools and Universities
- Environmentally compatible and resource conserving technologies increasing both qualitatively and quantitatively can also improve the competitiveness of technology driven companies on the global market
- The genuine uncertainty concerning the future level of the control fees will elicit a futures market in control fees
- Such a futures market will create conditions and opportunities for companies and investors to hedge against price fluctuations on the futures market and invest in new technologies to increase their competitiveness and to reduce their costs
- Since the futures market offers an insurance function against variations in the level of the control fees it can improve the conditions for a more secure and smooth transition to environmentally compatible and sustainable technologies, without wiping out vulnerable companies and businesses prematurely, otherwise resulting in unnecessary destruction of capital
- The technology development and the changes in the production process will send signals to decision makers and investors to invest in winning concepts in business choosing solutions based on "Cleantech"
- If the revenues from the flexible fees are recycled to the consumers, a general acceptance may be created in the transition towards a sustainable development

- The repayment of the revenues, from the control fees, to the consumers can increase the utilized purchasing power resulting in increased demand, increased rate of investment, increased rate of employment and an increase rate of environmentally compatible production
- Sufficiently high control fees are a guarantee that the production of goods and services will continue to become more environmentally compatible, resource conserving and sustainable
- The revenues from the control fees may also, to a certain extent, be used to strengthen the budget and/or to subsidize prioritized research and environmentally friendly technologies

12. Appendix 6

Results of Questionnaire (22 questions from Workshop)



Flexible fees:

1. Have the potential to stimulate the market to reduce emissions
2. Can stimulate job creation
3. Can impact economic growth positively
4. Can engage market forces to focus on emissions and externalities
5. Can reverse the trend of ecological services degradation
6. Represent a method to put a price on pollution
7. Are easy to understand
8. Are easy to implement
9. Will be popular with the general public
10. Will be accepted by businesses
11. Will be accepted by the finance industry
12. Should be levied on potential pollutants at the national entry/ extraction point
13. Should be channelled back to all tax-paying individuals
14. Will be accepted by environmental activist groups
15. Will be accepted by the vehicle industry
16. Are something that Government agencies possess the skills required to introduce
17. Are something companies have the skill to adapt their strategy to
18. Are something I can imagine promoting in my own organization
19. Can stimulate demand for clean-tech and recycling
20. Will cause a futures market to arise where actors hedge against
21. Will allow companies to transition to sustainable technology without premature destruction of companies and the capital behind them
22. Will not hinder trade between countries and continents

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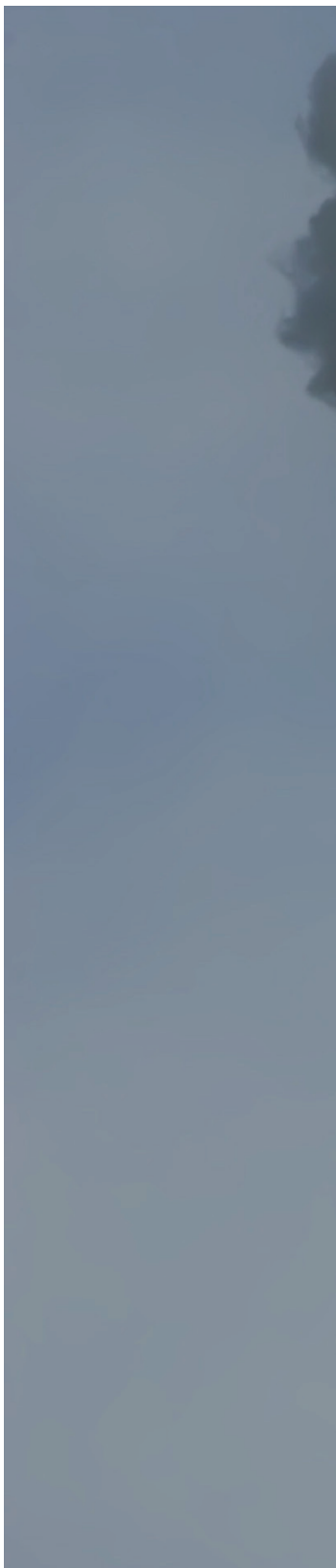
Flexible emission fees

An incentive for driving sustainable production and consumption

This report explores the urgent question of how to transition to a green economy. If the price of pollution becomes the same as the price to not pollute, i.e. the investment required for a non-polluting solution, could market forces be harnessed to create a totally green economy? Would the consumer lead the way if pollution fees were simply credited into everyone's account? Would economic growth and technical development forge ahead? Taking the flexible fee mechanism proposed by Höglund as a starting point, the report examines the academic literature and presents the results of a workshop where leading Swedish economists and environmentalists examine the issues involved in price discovery mechanisms and call for further developments in this field.



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