

# BONUS call 2012: Innovation

Project acronym: **phosmark**

**Applying economic incentives to stimulate the market to adopt eco-technology and create a society with zero emissions of phosphorous.**

**Using Gotland as a test case and as a Sweden in miniature.**

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Project applicants: Celia Peterson TNS FINLAND, Tea Nommann SEI Estland, Bengt Simonsson, TKM

Key theme addressed: The fourth strategic objective aims at improving the capabilities of the society to respond to the current and future challenges directed to the Baltic Sea region

This project addresses theme 2.4 Eco-technological approaches to achieve good ecological status in the Baltic Sea

Subthemes:

4.1 Governance structures, policy performance and policy instruments

4.2 Linking ecosystem goods and services to human lifestyles and well-being

## Project Concept

The Project PHOSMARK looks at the Baltic Island of Gotland not only as an innovation object, but also as a Sweden in miniature. The starting point for the project is:

- **the major challenge** phosphorous presents: The Stockholm Environmental Institute ranks it as the fourth most urgent planetary boundary to be addressed, it is one of the major emission challenges for the Baltic, the ecological balance of the sea is threatened if emissions continue. At the same time, supplies are said to be limited and an alternative handling regimen is needed within 30 years.
- **the aim** to make the Island phosphorus emission-free and net phosphorus import-free well before there supplies of phosphorus rock are depleted.
- **the position** that market forces will drive the transition given the right economic incentive framework and information to the market.
- **the understanding** that residents need to be closer connected to the flow of phosphorus through their island to enable a sufficiently timely transformation of their community infrastructure.
- **the achievements** of earlier work in identifying the challenge of phosphorus recycling, the available technology and the work done on developing fee systems and other economic incentives.

**Thus, the vision is one of the island as a good neighbour** that has no release of phosphorus into the Baltic, and one of a resilient community; a community that has broken its economic reliance on phosphorus from finite rock sources.

Import of phosphorus and the costs society incurs from business and societal activities that emit phosphorus represent a “leakage” of money from the island. With this leakage of money goes leakage of jobs. By retaining and recycling phosphorus there should be a net increase in economic activities on the island.

The technology field is that of phosphorus handling, and the strategic concept the project rests on is that technology and practices to achieve zero emissions and break rock-based import dependence are available. Furthermore, given a sufficient modification of fee, taxes and costs, along with sufficient information, the market will make the transition.

Working from a baseline established using a cross-discipline approach, the project will investigate the actual situation on the Island, and identify up to 12 “big hitters” in terms of inflow and emission.

These flows will be analysed to find “hot spots” - areas where decisions are taken and behaviours (of people and systems) take place to effectuate the flow of phosphorus.

The costs of leakage from these “big hitters” will be investigated and the “economic eco system” that the “hot spots” are embedded in will be mapped. (This includes the framework of taxes, fees and costs connected to system owners, operators and residents.)

Using the approach developed from the Nordic Council of Minister's recent investigations into flexible emission fees, economists will devise a fee and refund system that aims to eradicate costs of externalisation and to encourage recycling.

To bring island residents, business owners, public servants and policy makers closer to the whole area of phosphorus we will gather them in a one-day workshop along with a mini-exhibition of available technology and approaches.

The workshop will bring them into contact with the science, the technology, the lifestyle impact, the economics and the future scenarios. Reactions at the workshop will provide the research team with further valuable feedback as to potential barriers and drivers to the phosphorus -clean Island.

## **Objectives**

**to use** the Island of Gotland as a practical research object to identify a technological, societal and economic road map to transition to the zero phosphorus emission society.

**To investigate** the map with on-site, cross-discipline visits to critical “hot spots”.

**To develop** methodologies, including economic mechanisms and incentives, information approaches and to bring citizens closer to the sustainability challenge of phosphorus.

**To hold a public workshop** to try information approaches and gather feedback from all the stakeholder categories involved.

**To propose** a flexible fee and dividend system, along with a regulatory capability that will stimulate the market to cease emissions.

**To document** the project in a comprehensive report aimed at providing basic information for those in other disciplines and detailed economic, technical and scientific reports for experts and policy makers.

**To spread** the knowledge to stakeholders throughout the Baltic region.

## **Outcome**

Phosphorus becomes an issue sensitive to residents as it concerns how they farm, eat and how they excrete and take care of their waste. We aim to develop not only **economic mechanisms** to drive the transition, and proposals for **monitoring and regulating** these mechanisms, but also **methods of interacting with residents and other stakeholders** to bring them closer to the issue without alienating them, rather presenting it as an opportunity that is part of the economic development of the country towards sustainability.

The project report will yield valuable **experience in working in a cross-discipline way** with eco-system, technical system, technosphere approach aligned to the economic system.

It will provide **authorities and policy makers with a detailed view** of how pricing and taxing practices affect technology and material handling practices and a methodology to investigate the same. The project will yield valuable **experience in connecting residents, other stakeholders and the market with sustainability.**

The project will reveal any **gaps in technology** or methodology that need to be urgently addressed, as well as any key technologies (this may include phosphorous reclamation from the sea-bed) that will improve the ecological status of the Baltic and reduce costs on land.

## THE TREND, EXTERNALISATION AND SHORTAGES BOTH

### **Externalisation is continuing and awareness is rising**

As reported in the WWF publication COUNTER CURRENTS, Scenarios for the Baltic Sea 2030

“1)the tremendous projected growth which will place even more demands on an already over-stressed ecosystem, and

2) a governance framework that is not only unable to deliver the needed protection for

the Baltic Sea today but is clearly ill-equipped to meet the oncoming challenges.”

One of the main components of the stress placed upon the Baltic is phosphorus. At the same time, the peak of phosphorus production is getting closer.

What makes the need more urgent is that this essential element is soon to be in short supply. The WWF report states, when addressing peak of phosphorus supplies: “Initial analyses estimate that there will not be sufficient phosphorus supplies to meet agricultural demand within 30 to 40 years”.

LINK: <http://www.wwf.se/source.php/1492993/WWF%20Counter%20Currents%20-%20Scenarios%20for%20the%20Baltic%20Sea%20Towards%202030.pdf>

### **THE NEED IS FOR ECONOMIC INCENTIVES THAT DRIVE ADOPTION OF TECHNOLOGY AND PRAXIS**

Therefore there is a need to both curb emissions AND recycle this valuable resource. But is it a technological challenge? In one way, it is not as the technology exists. Comprehensive work carried out by Teknikmarknad AB in 40 municipalities revealed that the technology to recycle phosphorus is available. The problem is that it is not being bought, installed or used to the extent needed.

If policy makers do not act in a timely fashion, the risk is that the development and implementation of technology will stall; its price competitiveness will be overshadowed by cheap import of fertiliser and an unwillingness to invest in the transformation of the existing infrastructure. In the long term, without being able to recycle phosphorous the economy of the island will collapse.

### **THE MAIN IDEA IS THAT THE POLITICAL ECONOMY NEEDS TO PUT FEES ON UNWANTED MARKET BEHAVIOUR AND STIMULATE THE ECONOMY TO BEHAVIOUR THAT ALLIGNS WITH THE DEMANDS OF THE ECO-SYSTEM**

So innovation is needed in economic incentives. Although there has been some success with Cap and Trade, there is increasingly an interest in alternative economic approaches, but very few are given the chance to demonstrate their efficacy. A compelling, well-documented alternative approach that brings economy and policy down to the municipal level to drive market changes and supply chain adaptation is therefore badly needed.

## **FLEXIBLE FEE MECHANISMS ARE STATE OF THE ART**

Flexible fee mechanisms have been proposed by NASA climate scientist James Hansen as an alternative approach to CAP and TRADE. The Nordic Council of Ministers has completed two studies on flexible fees, the most recent covering nitrogen and phosphorus. However, these studies have been at a high level and the recommendation is that the mechanism shows sufficient promise that it should be applied to an actual challenge to understand better how fee-setting and redistribution of money can drive sustainable development and economic development.

Flexible fee mechanisms are at the cutting edge of economic policy development. They take the idea that externalisation should cease completely. Instead of a polluter pays approach they take the stance that it is the supply chain that should adapt, and that if the supply chain results in pollution a fee should be set and raised at regular intervals sufficiently so that the market responds by adaptation. In this way, the price of pollution is discovered, as the price to pollute becomes the same as the fee that stops pollution.

The mechanism depends on information reaching the market. Not only is the price signal information, but the flexible fee mechanism redirects the money back into the economy, for example through a general tax refund. This ensures that economic growth continues despite the imposition of high fees.

Another innovation is the decision network approach involving the whole technical and economic “eco-system” surrounding the individual: perceptions, price points, cultural norms, rules and regulations, systems, processes, infrastructure etc. This approach has been used in industry to improve quality, where a team was sent to analyse the point of fault. It is not approached initially as an individual employee responsibility, but a system fault. (It is called going to the spot, or asking “why” five times) a variant of this has been pioneered by consortium partner SEI in their WD-NACE methodology.

The technology road mapping approach will give the Island a clear picture of the potential of technology available to close the phosphorus loop. This will inform municipal and private investment decisions. Should technology not be available, the road mapping will inform the market and governments where investment will be needed and give some idea of the time frame possible. Possibly the technology of sea bed phosphorus reclamation can be shown to be profitable given the right economic conditions. This might both close the loop and reduce the burden on the eco-system.

The limitation of technology road mapping is that it can only encompass technology that is available to order with a degree of certainty. Technology under development is hard to foresee how the market will react, if at all, and therefore the map of future technology will only be educated guesswork.

The multi-disciplinary approach of “going to the hot spot” will give all stakeholders a picture of what is involved in terms of the behaviour, the system, the economic framework, the ownership, etc. This will inform all stakeholder decisions from private investment to policy changes. One limitation of the multi-disciplinary approach is that in order to create something that can be dealt with academically, the model has to be somewhat simplified. A possible limitation this presents is that parameters are missed that may turn out to be vital later.

The flexible fee mechanism, with its market signal and dividend refund approach will clarify opportunities to drive the market via policy decisions. This can be likened to applying a congestion charge, in this case not for flow of traffic through a city, but for the “traffic flow” of phosphorus through the island. One limitation is that it requires that the fee be set high

enough and the information of the economic effects be transparent enough for the market to respond. This means that national fee setting may be needed, and in the scope of this investigation we can only simulate national policy making.

The multi-stakeholder workshop and mini - exhibition, with its graphical representation of the flow of phosphorus, its decision walk through and scenario thinking will further inform stakeholders, and give valuable feedback on the efficacy of the three approaches above, not least furthering understanding of public and stakeholder reactions. One limitation of this approach, in common with focus group approaches is that the feedback you gain is deep, but not wide from a statistical point of view.

The final report's first section will offer a popular and graphic description of the need to close the phosphorus loop and its possibilities and opportunities. Because it is focussed on a real Island, with real available technology and using actual fees and dividends, it will present a valuable, comprehensive basis for discussion for experts and laypeople alike, and be made available to download separately,

The other sections will be for the stakeholders on a professional basis. The advantage of designing a comprehensive report structure like this is that it explores techniques for bringing citizens closer to the issue of phosphorus. At the same time, the later sections allow for a deeper economic and scientific approach. Each step of the project will generate learnings and the plan is to reflect on each stage as the project progresses, the reflection being published as an appendix, but given added value by being summarized in the second section of the report.

The objective of the project is to propose how to stimulate the market to bring about the transition on the Island to align with the ecological constraints of the Baltic by becoming a zero emitter of phosphorus. This will greatly contribute to the ecological status of the Island, as the island will be behaving in a more ecologically mature way (c.f. Odum). These changes would be market driven as the result of innovations in the national and municipal fee and tariff framework. The market includes public sentiment. Publishing, discussing and developing these innovations will contribute to increase the capability of communities around the Baltic to function both economically and without phosphorus emissions.

Firstly, the road map will inform investment decisions; it will show investors why some technology is key, and show purchasers what is needed to alter the technical infrastructure.

Secondly, the economical and decision framework analysis will reveal where policy needs to develop. The resulting proposals will take Gotland closer to zero emissions and demonstrate a way forward for Baltic States.

Finally the spread of results, via the workshop and report will further help to inform the discussion and demonstrate how to drive change.

#### **THE KEY CALL THEME:**

**The key call theme is Eco- technological approaches to achieve good ecological status in the Baltic Sea**, and will be addressed by creating the road map of behavioural and technological changes needed to curb phosphorus emissions from Gotland as well and give a road map for the introduction of fees and dividends that will drive the market to adopt these changes. The study will highlight key technology and praxis that, if sufficient economic incentives are in place, will be in demand at a level to stimulate a market response. The study will propose such economic instruments and investigate ways to introduce them and their viability.

This brings in the sub-theme 4.1, structures and policy instruments. Without the instruments in place, new technology will not be stimulated and the power of the market to solve problems will not be harnessed. 4.2 is also brought in, in eco-system service linked to life-style. The phosphorus imbalance in the Baltic is linked to the use of the common toilet, labour-saving agricultural practices and how we dispose of organic matter like food. The investigation will dig deep into these decision points to find ways to connect citizen's life-styles with technology and the regulatory and fee framework they live in.

## **HOW THE PROJECT WILL PRODUCE THE OUTCOMES FOR THE THEMES**

For the theme 2.4 Eco-technological approaches to achieve good ecological status in the Baltic Sea, it will identify where phosphorus is leaking into the Baltic, and the road map of technology changes required for this to cease. The project will achieve this by building on current technology studies and mapping them against current known flows to identify the 12 “big hitters” of inflow and outflow.

For the subtheme 4.1 Governance structures, policy performance and policy instruments, the project will produce a proposal for fees and dividends in an economic framework that will drive the market to adopt existing technology. It will do this by applying the flexible fee mechanisms approach that works by introducing dynamic controls into the economic system, like and advanced form of congestion charge mechanism.

The subtheme 4.2 Linking ecosystem goods and services to human lifestyles and well-being, the project will apply a research and mapping methodology that identifies the economic, societal and technological framework surrounding behaviour at decisive points in the supply chain, or “hot spots”. These hot spots will be identified through mapping of the technology framework against flows, and will be analysed by visiting the sites and interviewing stakeholders at these sites, and following the line of questioning to discover why they or the systems they are responsible for performing in a way to emit phosphorous. This work will link behaviours, life style choices to the ecological impact they make and be presented and fed back to Islanders at the public workshop, where their life style, the ecological impact of their lifestyle on the Baltic, and the outlook for the economy of the Island will be presented along with the life-style and economic opportunities that closing the loop might bring.

## **SPECIFIC POLICY REQUIREMENTS AND SPECIFIC NEEDS THAT WILL BE MET**

In terms of specific policy requirements for achieving a good ecological balance in the Baltic, the project takes the stance that policy makers are in need of an understanding of how fees on unwanted market and supply chain behaviour, specifically the import of rock-based phosphorus and the emission of phosphorus into the Baltic, can be levied in a way that will drive the market to cease externalisation whilst retaining economic growth. Policy makers need concrete proposals and a viability analysis to be able to move the discussion forward towards trials.

In this case, the customers are policy makers and policy influencers which includes industry, politicians and the general public.

The specific needs to be met by the project are for economic incentives that drive adoption of appropriate technology and praxis that produces a good ecological status in the Baltic.

- the changes in technical infrastructure needed to reach zero emissions, and
- how policy changes could drive the market to adopt them.

The customers are all the market actors, from consumers considering their waste system purchases to municipal policy makers and technology buyers. The main target is economic policy, and political economy decision makers and influencers. In the larger perspective we believe the project will inform national policy on import of fertiliser and waste handling policy for municipalities and county administrations.

Specific questions that will be addressed include:

- Where are the 12 most strategic, from a technology road map change perspective, points of import and export of phosphorus from the Island?
- What changes in the economic framework could be introduced to stimulate market adoption of these changes
- What is the reaction of the consumer to this line of thinking? To what extent are they prepared to see their life-style changed and to what cost?
- To what extent are technology investors willing to risk participate in the transformation of the Island. What benefits do they see?

The specific policy areas addressed by the investigation will be

- 1) the possibilities of increasing unsorted and decreasing fractionated waste stream handling fees if the fee is diverted back to the consumer
- 2) The location of the fee in the supply chain, a weighing of the alternatives
- 3) The location in the administration and the functioning of the body that sets the fees
- 4) The capability to monitor progress and respond with changes in fee levels. Ensuring the authority has sufficient information and capability to make changes and inform the public.

## THE APPLICANTS

**TSSEF: The Swedish Sustainable Economy Foundation.** Persons in charge, Stephen Hinton, BSC. Stephen is overall responsible as project manager. Key personnel: Anders Höglund, inventor of the Flexible Fee mechanism. Anders will take charge of the work with applying the flexible fee mechanism to the assignment framed as a result of the hot spot analysis. Stephen and Anders are both board members of TSSEF. TSSEF has been involved in recent Nordic Council of Minister's Flexible fee projects where TSSEF has taken on the task of combining economic incentives with the need to drive technological change, working together with industry and university specialists, the results having been published in the recent report from The Nordic Council of Ministers [Flexible emission fees – An incentive for driving sustainable production and consumption](#).

**TNS Finland.** In charge: Celia Peterson. Celia Peterson, together with members of the Natural Step, will lead the identification of the decision hot spots and prepare the popular material for the report. Cecilia will organise the Public Workshop on the Island as well. The natural Step are well known for their work in bringing complex ecological challenges to the public and to industry using a cross-discipline approach.

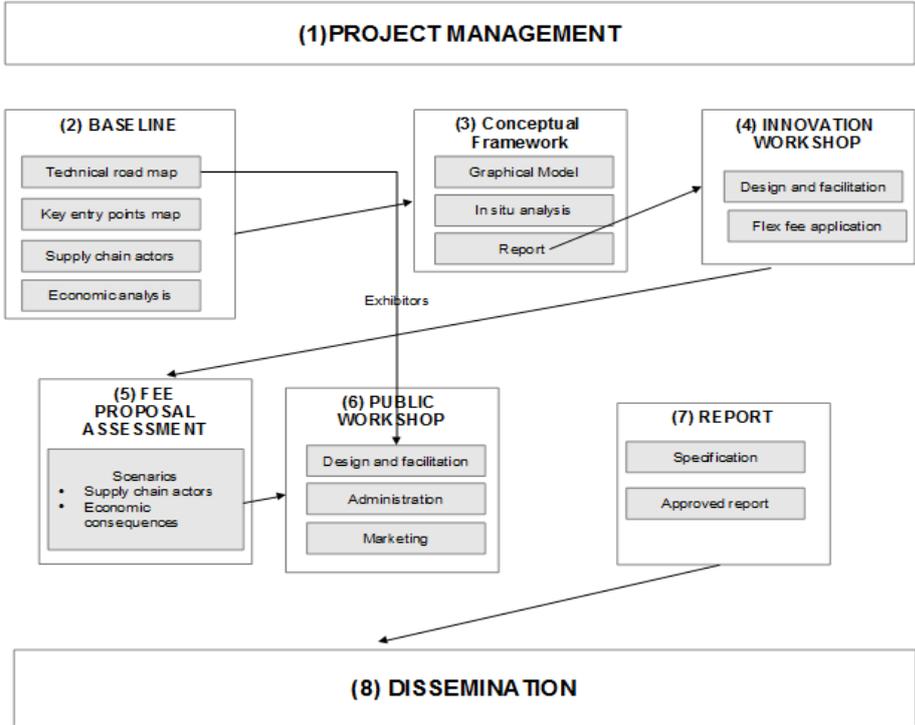
**The Stockholm Environmental Institute**, Tea Nömmann will lead the work including the scientific verification of the major flows of phosphorus identified. Flavio Gazzani a Political Economist will lead the economic work to identify and verify the flow of money around the phosphorus supply chain. SEI are well known for their ground-breaking work on the planetary

boundaries where a group of 28 internationally renowned scientists propose that global biophysical boundaries, identified on the basis of the scientific understanding of the Earth System, can define a 'safe planetary operating space' that will allow humanity to continue to develop and thrive for generations to come.

Teknikmarknad AB , lead responsible Bengt Simonsson, Bengt will create the technology maps and road map, and work to make sure the scenario analysis aligns with the constraints and opportunities offered by technology. Teknikmarknad is leading in bringing together ecological understanding together with technology to create overviews and detailed analysis that maps ecological needs and technological infrastructure. Teknikmarknad have successfully completes a survey of 40 Swedish municipalities' technological status mapped against ecological status.

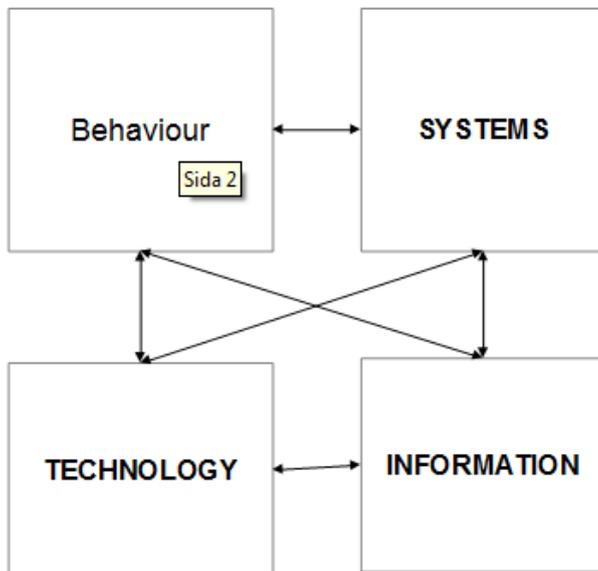
Sustainable development needs four main perspectives all to collaborate closely: technology, represented by Teknikmarknaden, Information and educations, represented by the Natural step, a systems view represented on the economic side by TSSEF and SEI and by Natural Step in general ecology. The behaviour view is represented by SEI's work.

**WORK PACKAGES**



## MULTI-DIMENSIONAL ANALYSIS:

The project looks at the four dimensions of change, and how they interact with each other.

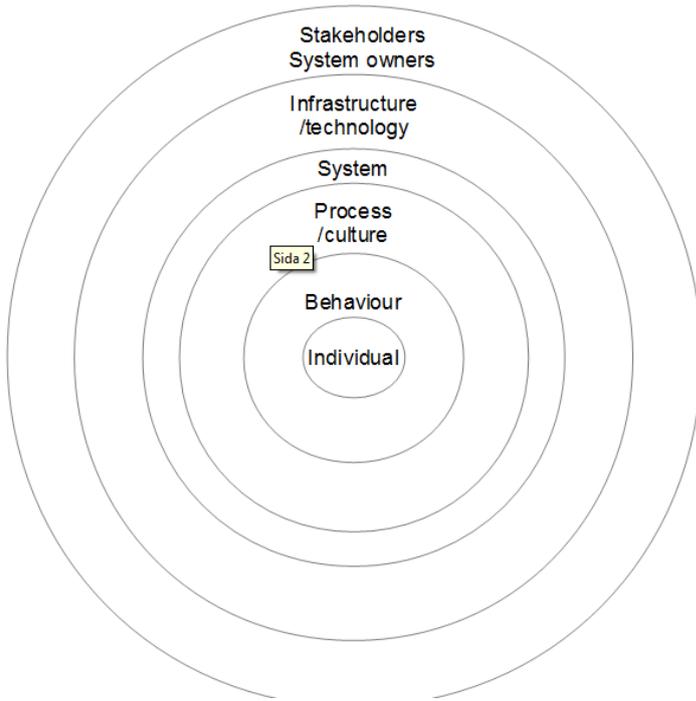


## THE LAYERS AFFECTING BEHAVIOUR CHANGE

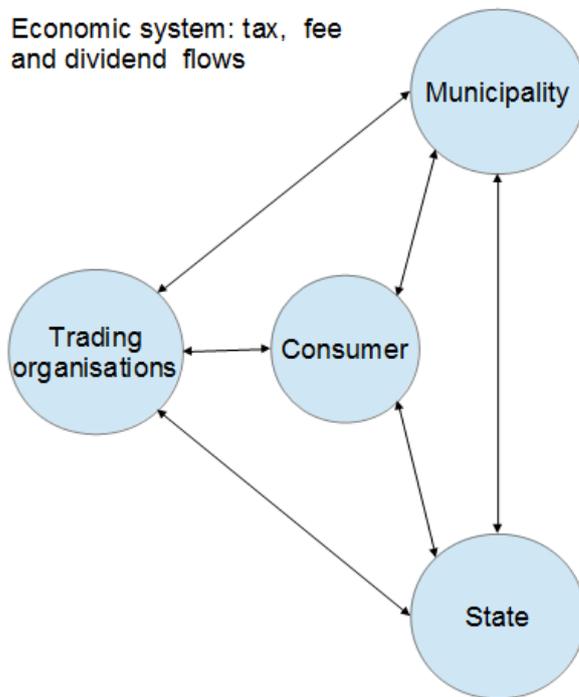
The project starts from the premise that there is always one behaviour that is the agent of emissions. The approach sees the emission from the point of view of “if a \*person\* never \*action\* then there would never be any \*pollutants\* reaching the biosphere.

The analysis follows the systems that the person is operating within, including the infrastructure and the stakeholder ownership to discover what would be a reasonable series of changes to make to reduce or cease emissions.

Based on the identification of changes needed, the information and the changes to the economic framework are also identified so that changes and initiatives can be planned.



Economic system: tax, fee  
and dividend flows



## References

COUNTER CURRENTS, Scenarios for the Baltic Sea 2030, WWF  
<http://www.amazon.com/Eating-Fossil-Fuels-Coming-Agriculture/dp/0865715653>

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

[http://minerals.usgs.gov/minerals/pubs/commodity/phosphate\\_rock/phospmcs07.pdf](http://minerals.usgs.gov/minerals/pubs/commodity/phosphate_rock/phospmcs07.pdf)

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

A good reference for total emissions burden on Sweden is <http://www.smed.se/wp-content/uploads/2011/10/SMED-56-2011.pdf>

The Nordic Council of Ministers :[Flexible emission fees](#) - [An incentive for driving sustainable production and consumption](#)