Energy efficiency in the maritime industry

Pre-study for assessing the need for, and methods for organizing, a network for energy efficiency in the maritime industry

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INTRODUCTION

PRE-STUDY FOR ASSESSING THE NEED FOR, AND METHODS FOR ORGANIZING, A NETWORK FOR ENERGY EFFICIENCY IN THE MARITIME INDUSTRY

This report outlines the possibilities for starting a network for energy efficiency in the maritime industry, as well as presents a proposal for how such a network could be organized.

The report consists of the following four parts:

→First, the purpose for starting a network for energy efficiency in the maritime industry is discussed. The purpose outlines the need for a network for energy efficiency.

→Second, the proposed structure for a network for energy efficiency in the maritime industry is presented. The structure outlines organizational methods and processes needed in order for the network to function properly. The need for an aim and objectives for a network for energy efficiency in the maritime industry is also discussed.

→Third, the steps needed in order to create a network are presented. These include the formation of a core group of companies willing and able to commit funds to the creation of the network, as well as creating an executive board in charge of the network. Also, methods for funding the network are discussed.

→Finally, the conclusion puts the proposed structure in context with the purpose for starting a network for energy efficiency.

BOX 1

In order to present the most important results in a clear and concise manner, they have been emphasized in boxes just like this one. If you wish to read the report quickly and get the important messages, just read the boxes. Reading the boxes lets you browse the report in less than 10 minutes.

The pre-study is based on interviews with pre-existing networks, both in other industries and within the maritime industry as well as with companies and organizations in the maritime industry. In total, 47 interviews with 54 people have been conducted. In addition to the interviews, conferences on energy, environment, the maritime industry and other relevant issues have been attended in order to widen the scope of the study.

The quintessential conclusion presented in this report is the finding that there is a need for establishing a network for sharing information and best practice regarding energy efficiency measures. The network is proposed to be managed by a coordinator, responsible for among other things organizing network meetings and dissemination of information. This need is based on the interviews in which company representatives have stated that there is a present need for a structured approach towards working with energy efficiency together with other industry stakeholders, and that there is lacking such an effort today.

It is widely agreed upon by the company and network interviewees alike, that energy efficiency will happen through practical projects, conducted by companies, either by themselves or in cooperation with other companies. These projects, however, are subject to many uncertainties due to lack of relevant information, lack of knowledge, or due to unclear financing possibilities and/or lack of satisfactory return on investment.

In order to increase knowledge about energy efficiency measures a network for sharing information and discussing relevant industry specific issues, both competitive and perhaps most importantly non-competitive, should be established. This network should focus on discussing solutions to pressing issues that are difficult to implement either due to lack of knowledge, or financial issues where a product or a methodology cost too much to implement in relation to its estimated savings.

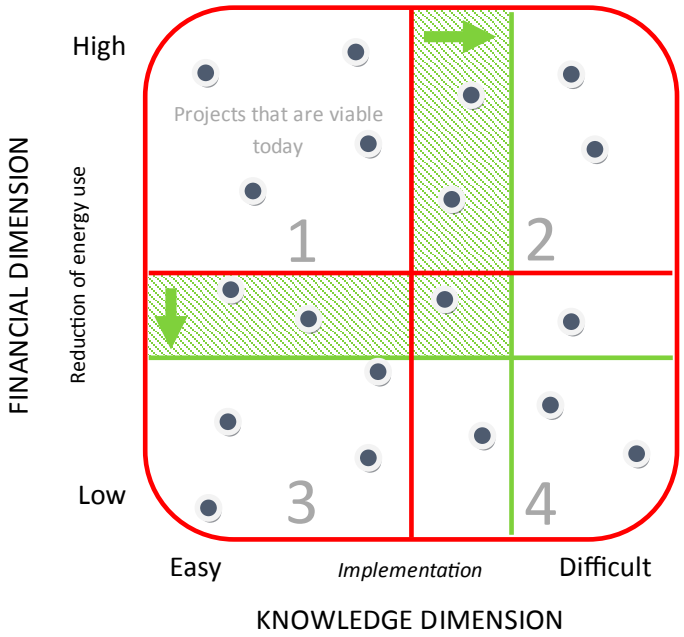

Figure 1: Projects matrix, identifying which projects are possible to realize from knowledge- and financial perspectives. Projects in the 1st quadrant are such as the companies can address even without the help of a network.

The network should aim at increasing the amount of projects that are viable to being addressed by the companies. The projects that are already viable today, i.e. in the 1st quadrant in Figure 1, are such projects that the companies are already working on, since they have an easy implementation regarding the knowledge dimension, and they are profitable in even a short term pay-back time.

The method for increasing the amount of viable projects is two-fold; it is based on increasing knowledge through collaboration and sharing of information, as well as increasing the return on investment by supplying funds to conduct projects that would normally be too expensive to the companies. This is illustrated by the green area in Figure 1.

Some companies might score higher in the knowledge dimension, whilst lower in the financial dimension. Such companies could help others through the network, by discussing ideas that might already have been implemented within their companies, and at the same time be able to gain help through the network with regards to funding projects that they were unable to fund themselves, due to shortcomings in the financial dimension. This should be the main strength of the network; combining the knowledge dimension with the financial dimension, testing different technologies and approaches by discussing them with other companies, and jointly approach issues that none, or only some, have addressed before. This way, the funds that are allocated to the network are put to best use for all participating stakeholders.

PURPOSE

FOR STARTING A NETWORK FOR ENERGY EFFICIENCY IN THE MARITIME INDUSTRY

The main purpose for starting a network for energy efficiency in the maritime industry is, at least, three-fold:

→Shipping is an essential part of today's globalized world, and is its role is estimated to increase even further in the future. The damage brought on by emissions from fossil fuel use is detrimental to the environment, as well as to human health. These emissions must decrease, and one of the most important and cost efficient methods for doing so is by increasing energy efficiency. A network for energy efficiency can help spread knowledge regarding which technologies and methods that are the most efficient methods available today among participating companies and help reduce energy use in the most cost efficient way possible.

→Energy efficiency is riddled with split incentives, making it difficult for companies to assess which method for energy efficiency is the most cost-effective method at any one time. Increasing bunker fuel prices will introduce new fuels and technologies on the market, but they will come at a higher cost than today. A network for energy efficiency can help share the costs of implementing new and unproven technologies that can have a large potential to save fuel earlier than what would have happened through market forces alone, and at the same time give participating companies a competitive edge, both on domestic and international markets.

→In Sweden, shipping must increase its share of transported goods. This means shifting transportation mode from land to sea, both in order to decrease harmful emissions from road transport, but also to shift from rail transportation in order to increase the availability of the rail network enabling an increase of public transportation for passenger travel. In order to speed up this development, a network focusing on improving the energy efficiency of Swedish shipping companies, as well as the efficiency of companies operating in the maritime industry in Sweden, could help increase the speed of which energy efficiency projects are carried out. An integrated view on how shipping can reduce land transportation, while reducing emissions of both global and local pollutants, will enable this shift. Thus, a network for energy efficiency in the maritime industry should have a broad approach to energy efficiency measures during the entire transportation chain where ship bound transportation is one part.

BOX 2

Due to an estimated increase in transportation volumes, both in the EU and globally, emissions from shipping are estimated to almost double by the year 2050. At the same time, the European Commission request emissions reductions from shipping to be 40-50 % relative 2005 emissions in 2050. One of the most efficient solutions to this problem is to decrease the energy use while transporting goods through energy efficiency measures.

So far, companies have been working with energy efficiency measures by themselves, or in specific partnerships. However, not all companies have the knowledge to take on large energy efficiency projects, whilst other companies might not have the economic strength to address the issues.
A network for energy efficiency in the maritime industry should be designed to tackle both the issue of knowledge transfer, and the funding issues. The reason for addressing the issues is to strengthen the Swedish

maritime industry, both domestically and internationally, by helping Swedish companies, or companies operating in Sweden, to cope with upcoming regulations and increased fuel costs in a cost efficient manner.

Transporting cargo, whether it is transported from China to Sweden, or from two cities within Sweden, is an energy intense business. The energy use in transportation has a large impact on the environment due to emissions as well as a social impact on human health and well-being, both on a local and global scale. Aside from transportation, other maritime operations use a large amount of energy for their operations, though their efficiency is more difficult to assess based on the nature of their operation.

However, carbon dioxide (CO_2) emissions must decrease from all industrial sectors in order to decrease human influence on climate change and other environmental issues, and it must be done rather quickly. European Commission guidelines stipulate that emissions from shipping must decrease by 40-50 % relative to 2005 emissions until 2050, i.e. in just 38 years. During the same time, shipping within the EU is estimated to almost double. Also, NO_x, SO_x, and PM emissions must decrease in order to decrease eutrophication and acidification, as well as decrease impact on human health.

This challenge must be met by all companies involved in transporting goods, from producer to customer, as well as by other companies involved in maritime operations. A broad approach must be made, where cargo owners, charterers, ship owners, ports, suppliers, ship brokers, classification societies and other stakeholders all work together in order to decrease energy use during the transportation of goods and in maritime operations. In order to meet future emission targets, energy efficiency is a key component that must be used to its full potential and constitutes an issue that must be addressed at every level within all companies in the industry.

These issues together form the basis for a network for energy efficiency, where the main reasons for addressing energy efficiency are three-fold, environmental, social, and economic issues.

The environmental issues consist of reducing the use of non-renewable fuels and the amount of harmful emissions, among others. Social issues are also concerned with emissions, where human health and well-being is being affected. Another important social aspect is worker conditions and safety onboard ships, in ports and in other areas within the maritime industry. These social issues are most often dealt with very high importance and in most cases where a trade-off between an environmental issue and a social issue is at hand, the social issue wins. In the end, though, all matters are governed by economic issues hence it is important to internalize environmental costs so they become verifiable economic targets for all companies.

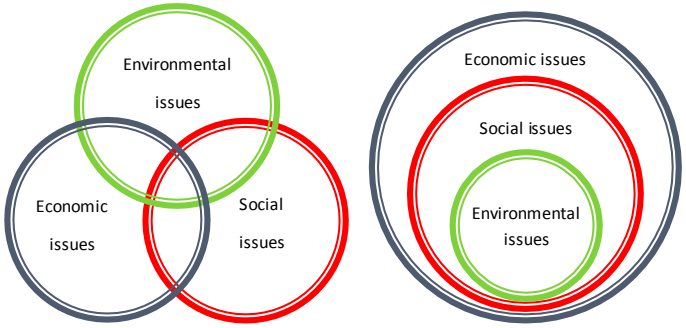

Figure 2: Two different perspectives on sustainable development. In general, most companies and industries operate similar to the figure to the right, where economic issues are the most important aspect. Environmental issues are sometimes, and social issues are, dealt with as economic issue making it possible to address the issues in financial terms. The economic aspects of environmental issues will rise in the future, due to the internalization

of environmental effects through taxes, regulations and other policy instruments, as well as market transformation. This will increase the cost of environmental issues hence less environmental impact due to less use of energy will have a clear effect on future earnings throughout the industry.

Today, split incentives riddle the industry, and a ship owner making energy saving improvements onboard a certain vessel might not benefit from the reduced energy cost, since the cost of bunker fuel is managed by another actor. Hence, it is difficult for companies to make relevant estimates for how much a certain option will cost, due to uncertainty in pay-back time. This must be addressed through better cooperation between different stakeholders within the industry, in order to address who should benefit from a certain energy efficiency measure.

It is also common that when fuel prices are high and freight rates are low, the earnings are low which means that companies have a hard time focusing on projects that do not have an immediate return. However, it is in times such as these that a network for energy efficiency can be of importance due to the possibility to support the implementation of projects that might not be possible to implement due to the financial situation. In better times, the network can act as an enabler for implementing products and methods that are close to market introduction by supporting projects, or by facilitating knowledge transfer between companies and academia alike.

However, bunker prices will rise in the future, and it is no use longing for a time when bunker prices were low. The basic fact that oil is a non-renewable resource makes it a fact that prices will rise as the supply of oil fails to meet the demand for oil based products. This increase in price will in turn drive technologies that are not profitable at today's prices towards the profitable region and also make it possible to shift to more expensive fuels. Energy efficiency measures is an easy way of staying clear from increased fuel prices, since whether bunker fuel prices increase or other forms of fuel become more readily available, the prices for them will be considerably higher than today. This stipulates a great need for energy efficiency, whether it is bunker fuel, LNG, methanol or any other non-renewable, or for that matter any renewable source of energy that is used. The price is going to increase, and the best possible way to avoid that is to work tirelessly on energy efficiency in all possible projects.

This network is proposed to address these issues, both by increasing the knowledge of what types of projects could be realized at a profitable cost already today, and also help usher in new technologies before rising fuel prices makes them profitable, hence giving companies adopting them a competitive edge compared to the companies that only react on fuel prices before implementing these projects.

Another issue which is an underlying purpose for starting a network for energy efficiency in the maritime industry is the presence of a large knowledge gap between the industry and academia which hinders the development of more efficient methods for fuel saving and other energy efficiency measures.

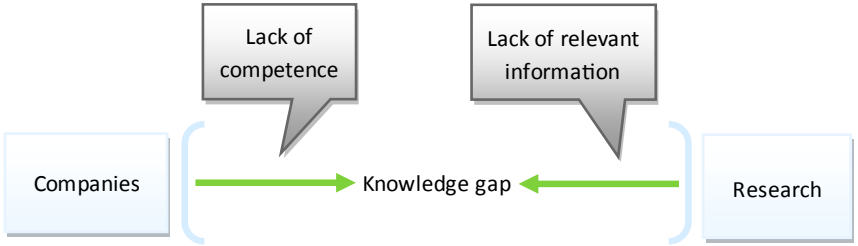

Figure 3: In this study, a knowledge gap between companies and academia has been identified. This gap can be viewed as shortcomings on both sides, where lack of competence (i.e. lack of relevant personnel, or lack of time for people with competence) is a hindrance for companies to attain the knowledge that is available in academia. On the other hand, academia is seen to be presenting information that is not relevant to the

industry, or at least not relevant in a short term perspective. This depends either on academia not conducting research projects relevant to the industry, or that research which is relevant is presented in such a way that it is impossible for the industry to attain and make use of it.

There is a lack of competence in the industry, whether it is based on a lack of competence in the available personnel, or lack of time, which makes it difficult for companies to address energy efficiency issues in the most cost-efficient way. Also, academia is failing in providing relevant information to industrial actors, both due to the reason of not addressing relevant issues, but also due to failing in providing understandable and relevant research that can be put into practical use. According to some company interviewees, there is also a perceived lack of competence within the industry when it comes to choosing the most energy efficient products and methods available.

These important issues can be addressed by a network for energy efficiency, through two main measures:

→Increasing knowledge and competence regarding energy efficiency within the industry through collaboration and knowledge sharing between industrial and other actors.

→Financial support from the Swedish Energy Agency in collaboration with participating companies, to companies willing to work with energy efficiency in a broad approach to solve energy efficiency problems.

This should put a focus on the needs of the industry, in order to facilitate an increased focus on energy efficiency measures. It is vital for the network to have industry backing, but it is also important that the network facilitates contacts between industry and academia for collaboration around projects, and for enabling researchers to access projects conducted by industry, without having to organize large research projects, since these are seen as slow moving and less results oriented by many company interviewees. Instead, the network should focus on supporting practical projects that are to be implemented at one or more companies with a clear focus on reducing the energy use and at the same time invite researchers to investigate the processes involved in implementing these projects and cross-check between multiple projects in order to find best practice from an array of different projects. This could help improve connections between academia and industry in order create a better understanding of academic projects and their results within the industry, as well as a better understanding of practical projects and the input they provide for research projects within academia.

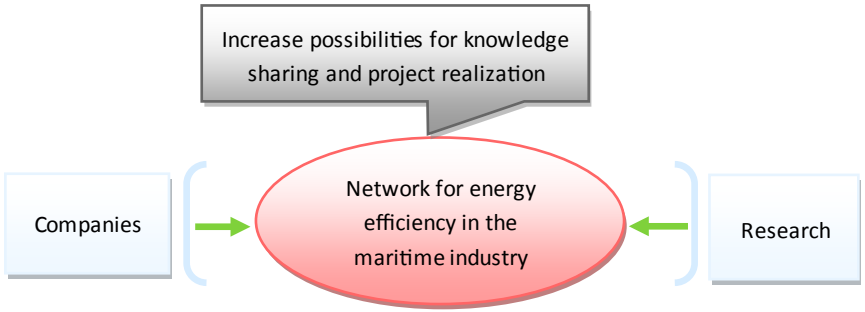

Figure 4: One major objective for the network for energy efficiency in the maritime industry should be to address the shortcomings of the perceived knowledge gap. This should be done through coordinating information to the network by including researchers as discussion partners and letting research be part of practical projects to work closely with industry. It should also make it possible for companies to attain the right competence, both through discussion with other companies and research, but also through project funding through the network, where the right type of competence can be given time and funds to address problems at hand.

One key component in a network for energy efficiency in the maritime industry is the possibility for discussions across companies and different segments in the industry. Shipping companies must have a dialog with

cargo owners, ship brokers, ports, classification societies, suppliers and other stakeholders in order to make relevant efficiency measures which do not sub-optimize the use of energy from a larger perspective.

Another purpose for starting a network for energy efficiency in the maritime industry is the possibility to speed up implementation of different projects, and to speed up the process in which support is given by public funds. Drawing on best practice in pre-existing networks, and opinions from company interviewees, there should be a strong focus on operating quickly between the identification of project ideas and project acceptance by the executive board, and an almost non-existing bureaucracy where the focus should be practical execution of the projects. This is seen as a lack in previous research and industrial projects; the information is most relevant for the companies and organizations that participated in the projects, which is by no means wrong, but there could be improved information dissemination from projects funded by public means.

This should be realized in the network through a strong focus on speed of implementation, and clear information channels so that information gathered by projects in the network are clearly disseminated to participating, as well as other, stakeholders in a relevant and quick manner.

For the sake of the maritime industry, and the possibility for young people in Sweden to see the maritime industry as a future oriented business, Swedish companies, as well as companies operating in Sweden, should come together in order to strengthen the industry's work on energy efficiency. This will boost the industry as well as public awareness of the huge potential that the maritime industry offers.

BOX 3

→The main purpose for starting a network for energy efficiency in the maritime industry is to:

1. Decrease emissions from shipping and maritime operations through decreasing overall energy use.
2. Facilitate the exchange of ideas and knowledge relating to energy efficiency in order to strengthen the Swedish shipping industry
3. Enable projects that are too expensive or too difficult to realize to get funding from the Swedish Energy Agency and the participating network companies in order to speed up development of energy efficient practices and technologies.

The network should be seen as the place to visit for information relating to energy efficiency in the maritime industry. Hence an overall objective for the network should be to have a broad perspective on energy efficiency measures throughout the entire industry.

PROCESS

FOR THE ORGANIZATION OF A NETWORK FOR ENERGY EFFICIENCY IN THE MARITIME INDUSTRY AND NETWORK PROCESS METHODOLOGY

This pre-study proposes that a network for energy efficiency in the maritime industry is formed by stakeholders in and connected to the maritime industry.

The proposal consists of four parts:

→A network coordinator and network secretariat in order to organize and manage the network and arrange funding to the different projects being conducted in the network.

→A network of companies (funding actors), that commit time and financial resources to work in collaboration with energy efficiency measures.

→An extended network of companies (non-funding actors), unable to commit financial resources at this stage, but willing to commit time to identify projects within their companies in order to join projects on a projects-by-projects basis, rather than being members of the actual network.

→An executive board of no more than a few people who are responsible for taking all executive decisions for the network, such as which projects get funding and other organizational and legal issues.

BOX 4

The proposal consists of four parts needed for the successful start and operation of the network.

1. A network coordinator, and a secretariat, to organize network meetings and manage network funds. The coordinator should be a person with good knowledge about the industry and energy efficiency measures, and also be able to draw on a large personal network in the industry. This position is estimated to be a half-time (50 %) position. The secretariat should keep track of economic issues, such as paying companies for their project participation and is estimated to be a 10-20 % position. These people could be part of the same organization, or they could be placed in different companies or organizations.
2. A network of companies (funding actors) that contributes with time and financial resources to the network, in order to kick-start projects and to conduct projects on their own, or in collaboration with other network companies. These companies form the basis for the network and are the core companies that should be referred to as members of the Swedish Energy Agency's network for energy efficiency in the maritime industry.
3. An extended network of companies (non-funding actors) that have ongoing discussions with the network coordinator regarding energy efficiency ideas and projects, and are invited to join network meetings when ideas that relate to their companies arise. However, they are not members of the network but they collaborate in projects initiated through the network when they have the possibility to do so.
4. An executive board to take all executive decisions for the network. The board should consist of no more than a few people representing the industry and academia, having good insight into the industry and the need for energy efficiency in the industry as a whole as well as a strong societal perspective. Preferably, they should not represent the companies that fund the network in order to stay clear from

biased decisions. They should rather have a broad view of what types of projects should be conducted within the industry as a whole. The board should co-opt (Sw: adjungera) one or two people with technical skills and academic merits when it comes to energy efficiency when decisions regarding project funding should be discussed.

The network coordinator should organize network meetings based on issues brought forth by network members, as well as from other industry stakeholders. The network coordinator then organizes meetings and invites companies that have a possibility to perform projects within these issues to a workshop where the issues are discussed.
Companies invited to a meeting must bring projects relating to the topics of the meeting in order to have a basis for decision ready at the meeting, since project ideas forming at the meeting will be used as a basis for decision for the executive board. Hence, no rounds of application or other heavy burden bureaucratic methods for applying for project funding is used, only ideas brought from the companies involved are of interest.

The network should be set up as a program by the Energy Agency, with a set amount of years for operation, e.g. 3-5 years. After the first program period, the network could receive renewed funding if the network has met its aim and objectives successfully during the first program period.

The network should consist of four main parts, a network coordinator and secretariat, network member companies, an extended network of companies, and an executive board.

The basic and most important aspect of the network for energy efficiency in the maritime industry is the network coordinator. The coordinator is in charge of the day-to-day operations of the network, and is in contact with industry stakeholders and network members. Issues such as dissemination of information through the network webpages, newsletter and other information channels, are tasks of the network coordinator. The coordinator is also in charge of organizing network meetings; the most important forum for discussion where project initiation in the network should take place. Based on ideas from companies, both member companies and others, the network coordinator organizes network meetings a couple of times per year. The amount of meetings to be held is up to the industry and coordinator, based on the amount of ideas brought forward and on the interest from the industry. Based on best practice, 2-4 meetings per year is an appropriate number of meetings. More than four meetings a year could make the schedule cluttered, and too few meetings might make the network disappear. However, if network meetings address different segments within the industry at different meetings, then there is a possibility for having more than four meetings a year.

The coordinator is responsible for inviting companies to the network meetings for discussing the ideas brought forward. Based on the amount of companies joining the network at startup, the meetings could be based on all participating companies if they are less than approximately 15. Then all meetings should involve an invitation to all participating companies.

If the number of members at startup, or at a later stage, is larger than 15, it is up to the discretion of the coordinator to invite the companies that are impacted by the issues at hand, based on earlier discussions with the companies. The reason for having some form of limit at or around 15

companies is the notion that meetings with more than 20 people tend to focus more on lectures and have a more educational focus, while meetings with less people have the possibility for everyone to have his or her say at the meeting, and that all projects ideas brought by the participating companies to the meeting can be discussed. Meetings that are too large will have a more formal setting and will not have the possibility to foster ideas and create an atmosphere where ideas can be discussed openly.

Extended network

Since there will be companies not able to join from start, due to lack of funding capabilities or other reasons, there will be a set of companies that are interested in joining projects and funding their share of a project when an issue concerning them will be discussed. It is then up to the network coordinator to invite such companies to the network meetings at occasions when it is seen fit to bring external companies to the meeting. The same goes for inviting suppliers for a certain component, product or methodology when such issues are discussed. This is one of the reasons for the network coordinator to have discussions with industry representatives prior to the network meetings, in order for the coordinator to be able to invite relevant stakeholders and relevant external companies to the network meetings and to foster a good discussion which makes it possible for companies to join together and focus on specific projects.

Network ececutive board

The executive board is to be responsible for the network, both in relation to member companies but also in relation to the Energy Agency. The board should take all financial decisions and all organizational changes made to the network should be decided by the board. The board is also responsible for the network to live up to its aim and objectives.

The board convenes at least the same number of times as there are member meetings during the year. A board meeting should follow approximately four weeks after a member meeting, in order for the board to discuss the project ideas brought forth at the member meeting in order to decide which projects get funding. At these meetings, the board should co-opt one or two additional members with technical skills relating to the projects at hand, e.g. a person from academia or from any of the companies not applying for funds at the present meeting. Also, the network coordinator should be present at the board meetings acting as secretary without the right to vote.

NETWORK PROCESS METHODOLOGY

The network for energy efficiency in the maritime industry should be organized following five main processes. These processes govern the work done by the network, and mainly the work done by the coordinator. It is up to the coordinator to act according to these processes, or variations of them, and work on improving them in order for the network to evolve and improve the processes based on industry and stakeholder needs during the program timeframe.

The five main processes that should be the focus of the network are:

→Discussions with industry stakeholders for basic information of what projects are of interest to the industry to work with. These discussions can be made with any company in the industry in order to gather ideas from all different stakeholders, as presented in Figure 5.

→Ideas brought forward through initial discussions then form the basis for a network meeting where a certain area is to be discussed in a project formation workshop relating to the subject at hand. It is also possible to address several issues at one meeting, but it is better to address just one or two specific topics at once in order to create a good forum for discussion, see Figure 6.

→Information dissemination and information feedback in order to spread information regarding projects in the network, as well as other energy efficiency projects being carried out within the industry, see Figure 7.

→Cooperate with other networks, organizations and initiatives in order to capitalize on work already done within other networks, and utilize combined strengths instead of reinventing methods and processes.

→Coordination with research projects to allow researchers to access projects conducted through the network; invite relevant researchers to access data and visit and interview companies conducting energy efficiency projects, in order for general data collection and organizational research relating to energy efficiency to be performed.

The first and most basic process in the network for energy efficiency in the maritime industry concerns the methods used to identify ideas and projects within the industry. The coordinator should actively work with visiting companies, discussing with industry representatives, and people working with energy efficiency in different companies. These discussions and meetings should form a basis for understanding the combined needs for different companies and the industry as a whole.

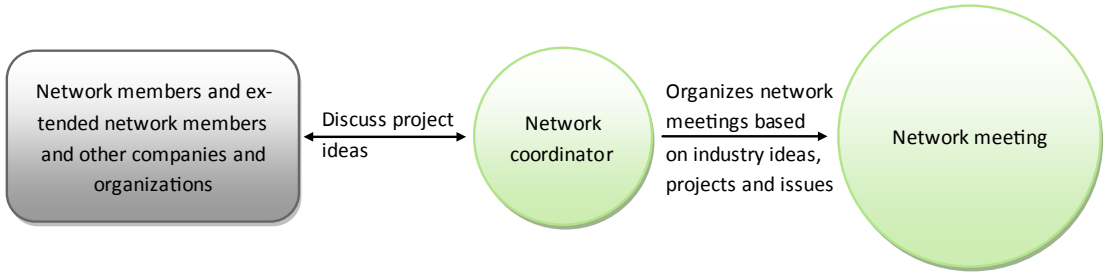

Figure 5: Network process methodology, discussions with network members and other stakeholders to identify project ideas. In order to assess the need for projects and the project ideas, the network coordinator is responsible for having ongoing discussions with network members and other industry stakeholders, in order to identify energy efficiency ideas already present in the industry. These ideas should then form the basis for discussions at network meetings which the coordinator is responsible for organizing.

Having discussions with ship owners, ports, suppliers, cargo owners, ship brokers, classification societies and other stakeholders, will enable the network coordinator to identify relevant topics for discussion to be used as a basis for upcoming member meetings. The coordinator will then be able to organize member meetings that are based on the needs of the maritime industry.

With the initial discussions with industry stakeholders and network members, according to Figure 5, the network coordinator is in charge of organizing a network meeting based on the ideas and projects. The coordinator invites people and companies that are relevant for the topic at the upcoming network meeting.

Companies that are relevant for having further discussions are invited to the network meeting, based on their ability to address the issues at hand. The companies that are invited to the network meeting should bring project ideas and projects that are relevant for the specific topic of the meeting, in order to base discussions on the ideas in the companies. Hence, it will be possible to decide if a project is worth financing or not at the member meeting. It is possible for companies that are not in the network to join as well, if they have the will to fund a project within the meeting topic.

Project ideas that are worth looking in to should be decided on at the meeting, and in cooperation with the network coordinator a brief description of the project idea should then be drafted and brought to the executive board for decision. The executive board then decides who should get funding for their projects based on the project's possibility to contribute to the aim of the network.

After the executive board decides which projects should get funding, the company, or companies, that proposed the projects can start working on the projects. In cooperation with the network coordinator, relevant researchers are contacted to see if the projects are of relevance for research projects. For all projects that get funding by the network, ideally there should be at least one researcher connected to the network for assessing the overall use of the network projects. This is to benefit the network companies through enabling a researcher or researchers to identify which projects are most valuable from an array of different projects, and thus being able to identify best practice projects throughout the industry.

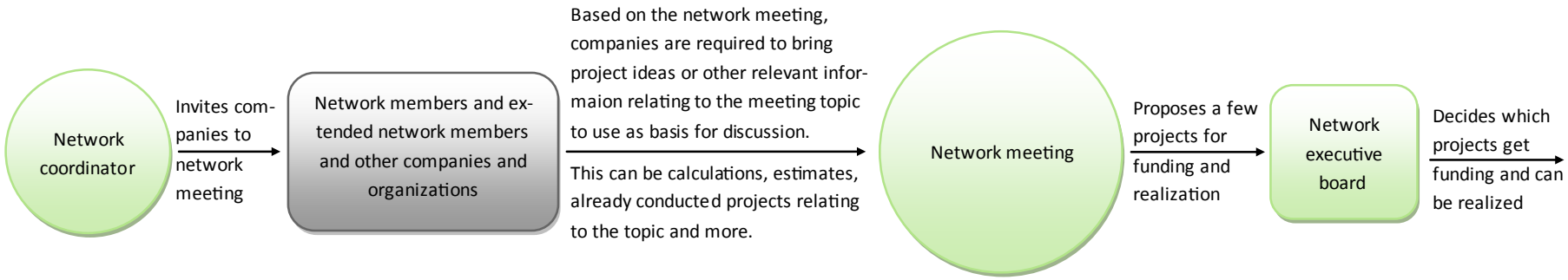

Figure 6: Network process methodology, organizing network meetings part 1. After discussions with network members and other companies, the network coordinator organizes a network meeting focusing on a specific energy efficiency measure. The coordinator invites, either all network members, or the network members that are relevant to the topic. Invited network members, and other companies that have relevant project ideas investigate ideas relating to the meeting topic at their companies, and bring project ideas and other relevant information to the network meeting. At the network meeting, the companies present at the meeting discuss the ideas brought forward and then decides on a few project ideas that are worth pursuing. These ideas are then brought to the executive board which decides whether to fund the projects, based on their relevance for the industry and their estimated savings.

After the projects are finished, the companies contact the network secretariat and hand in a project work sheet showing project completion, in regards to the amount of hours worked on the project and other relevant material. The reason for having a project work sheet is the possibility to show if the project has reached the project goals decided by the executive board. Upon receiving project information, the secretariat reimburses the company for the project expenditures.

In cooperation with the network coordinator, a short project report is drafted where the main characteristics of the project are presented, e.g. energy saved, implemented methods and material, and other project specific issues. This report is then presented to the network members and on the network web pages in order to benefit the industry as a whole. These reports should not be bureaucratically difficult to draft, but should rather be based on a template which is easy to fill out, in order for the network to present its information in a similar and coordinated manner.

One of the main benefits of being a member of the network, or by joining a specific project conducted in the network, is the possibility to access in-depth information about the implementation of different projects in the network. After a specific project is finished, the company or companies that conducted the project are responsible for attending an upcoming network meeting where their project is up for discussion as a part of the network's focus on information dissemination.

This methodology enables other companies to discuss the implementation and other issues regarding the project with the project manager that conducted the project. Instead of just reading a report regarding a specific project, the network meeting should foster discussions regarding project completion and other issues that will be beneficial to companies that did not participate directly in implementing the project, but rather participated through their membership in the network and by supplying funds through the network.

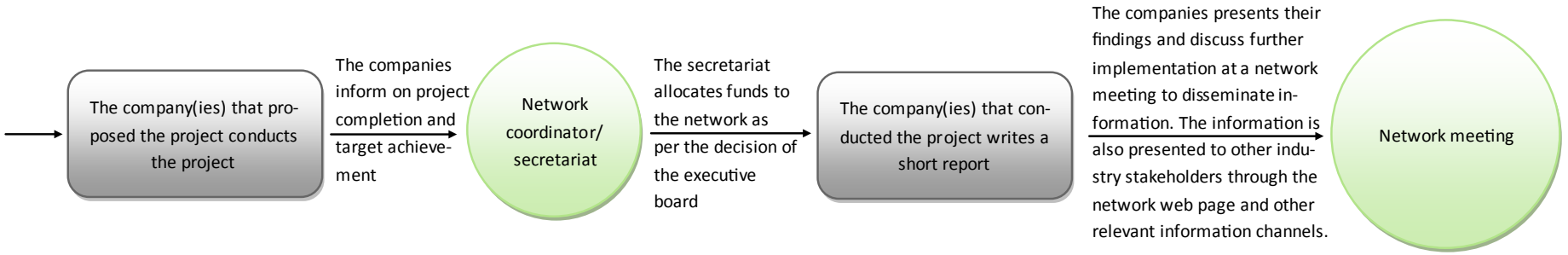

Figure 7: Network process methodology, organizing network meetings part 2. The projects that the executive board decides to fund can then be realized, either through companies that implement them themselves, or together with other companies, or by employing a consultant for performing the project. Depending on the timeframe of the project, the companies report to the network coordinator and for a short project the secretariat pays the agreed upon funds to the company upon project completion. For projects with a longer timeframe, funds can be allocated during the project when specific targets have been achieved. After project completion, the company(ies) that have conducted the project writes a short report based on a report template supplied by the coordinator. In order to achieve maximum use of the conducted projects, the companies that have conducted the projects are then supposed to attend an upcoming network meeting and discuss project results, difficulties and other relevant issues. Also, ideas for improvement to the project and follow up projects can be initiated at this network meeting based on results from the project.

After a project is finished, there might come up new project ideas, either regarding further implementation at the companies that conducted the first project, or additional implementations at other companies. The latter case may involve a different method or product as well as assertions of which method is the most energy efficient or the most cost efficient. These issues could then be discussed at the member meeting where the project completion is presented, in order for the network to foster new projects and ideas based on projects conducted by member companies.

Additionally, it is up to the network coordinator to have contact with other networks and organizations within the industry, in order to identify project ideas brought forward in other instances within the industry. It is also up to the coordinator to identify possible cooperation projects that can be organized with other networks, such as the Clean Shipping Project, CLOSER, EMIP or other networks and projects working with energy efficiency or environmental issues.

All companies joining the network should appoint at least one person in charge for having contact with the network, so that information is disseminated quickly and efficiently. The coordinator should know exactly who to contact in a specific company to facilitate communication. This is important both for discussing project ideas, but also for inviting companies and specific people to network meetings.

The network meetings should be free of charge, but attendance should be by direct invitation only. If a company, funding or non-funding actor alike, has a valid proposal that is in line with a network meeting, then that company could be invited to join the meeting by the coordinator.

NETWORK ORGANIZATION - COORDINATOR, SECRETARIAT AND EXECUTIVE BOARD

The main and most important features of the proposal are the network coordinator and the executive board. Hence, it is important to address the organizational features of the coordinator, the secretariat and the executive board. This pre-study outlines three main possibilities for how to organize the coordinator function. These three coordination methods all have pros and cons, and the organizational functionality of the network coordinator will most probably have an impact on the focus of the network.

Coordinator

One important aspect regarding network organization is where to place the coordinator and secretariat. The coordination of the network is decided by the Energy Agency after a procurement procedure, which will be based on both ideas brought forward by the executive board and the Energy Agency, after which the Energy Agency decides where the network coordinator should be placed. This is in turn a decision which puts focus on what type of coordination the Energy Agency sees that the network should have.

The three options consist of:

→Placing the network coordination at a business or trade organization, such as Swedish Marine Technology Forum (Sw: Svenskt Marintekniskt Forum, SMTF), Maritime forum (Sw: Sjöfartsforum), or at the Swedish Shipowners Association (Sw: Sveriges Redareförening). This organizational position puts emphasis on the placement of the coordination as an integrated part of a part of the industry. Having the Swedish Shipowners

Association as the coordinator would put a focus on Swedish ship owners, just as SMTF would put focus on issues relating to SMTF member issues. Maritime forum could be seen as a having a more integrated industry focus.

→The second option would be to place the network coordination at a consultancy firm or at a specific company in the industry. This option promotes SSPA as a specific place of organization where the coordinator could be placed. SSPA has a strong interest in being a link between academia and industry and already organize industry connected projects with the sort of short time frame discussed by companies during the pre-study. This alternative might create difficulties when the company in charge of the coordinator also wants to cooperate in projects, hence situations where bias might arise could be a problem.

→The third option is to place the coordination in an academic setting, where Lighthouse would be the obvious choice. Lighthouse is working on increasing company participation in its structure, which would enable a greater connection between industry and academia. Also, an academic setting would constitute an unbiased setting for the coordination. However, placing the network in an academic setting could prevent some companies from joining due to reasons such as companies seeing academia being too far away from the industry in some cases. On the other hand, this is something that the network will aim to overcome.

The interviews with company and organization representatives have shown split views on where the coordinator should be placed. Some favor placement at a trade organization, while others would see such coordination as too narrow and would only serve the companies involved in the specific organization. However, Maritime forum has been voiced as an inclusive organization where the coordinator could be located, though the small scale of that organization is seen as a negative issue.

Some interviewees have seen the choice of having the coordination at SSPA as a good alternative, since they are seen as a link between academia and the industry. Other interviewees have commented that there is not much difference between SSPA and Lighthouse, and hence a placement at SSPA would be equivalent to placing it at Lighthouse. Placing the coordinator at a company has also been seen as somewhat problematic by some interviewees.

Placing the coordination in an academic setting has been seen as a good option by some interviewees, who have stated that Lighthouse should be the natural place for competence enhancing projects within the industry. The fact that Lighthouse is an organization serving the entire industry is seen as a guarantee for having strong focus for the coordination. However, some interviewees have seen Lighthouse as too academic, having problems communicating with companies and discussing their real-world problems. Others have seen the need for Lighthouse to widen its scope, and therefore considered that placing the coordination at Lighthouse would be an important step in that direction.

All in all, there are pros and cons with all choices. The most important aspect is that the industry representatives and the companies that choose to fund the network in cooperation with the Energy Agency come to a conclusion regarding which option should be most beneficial for the industry as a whole. From best practice in pre-existing network, all the above versions of network coordination have been represented.

One important aspect relating to the coordination of the network, and the coordinator specifically is the notion that it might not make such a large

difference where the coordinator is placed. Some of the organization and company interviewees' stated that the most important aspect is that the coordinator is a person with deep knowledge in the business and with a competence to understand the projects at hand. It should also be a person with a strong network within the industry and academia, in order to draw on knowledge about previously conducted projects. This means that the person might be more important than the location, which should be taken into account when starting the network.

Secretariat

The coordinator could be in charge of financial issues as well, but it is easier to leave this to a secretariat and a person focusing on economic tasks. This secretariat could be placed at the same place as the network coordinator, or it could be separate. The main thing is that the secretariat is responsible for the resources that the energy agency and the member companies put in an allocated fund for projects. This means that the coordinator could be located at one industry actor, and the secretariat at another actor. This method could be used to strengthen the ties between two actors, e.g. by placing the secretariat at the Swedish Shipowners Association or at Maritime forum, and the coordinator at SSPA or at Lighthouse, respectively. This option has a strong basis in best practice where the network secretariats have often been located at trade organizations and the coordinators have been located at actors within industry, such as academic or company actors.

Executive board

The executive board could be organized through two different methods. Similar to both methods are that the Energy Agency decides which people are to sit on the board, based on network member input.

These options consist of:

→All funding companies and organizations get to propose one member of the executive board. This option gives all contributing companies a say at what projects should be conducted, however a board constructed in this manner would premier the companies that have joined. This could create a possible bias in the decisions, where external companies could have difficulties getting project funds.

→Creating a small executive board with just a few people from industry and academia. The board should have the entire industry as its focus when taking decisions and not only focus on the companies that have contributed funds to the network. This type of board would also have the possibility to co-opt board members with technical knowledge, either from industry or academia, when decisions are to be made. This board would also be easier to convene, since a small board would have the possibility to have e-meetings and their work would be easier to schedule.

CO-FINANCING THE NETWORK

From best practice in pre-existing network, there are diverging views on what type of co-financing that is the best method. However, a clear distinction of funding and non-funding actors should be made, even though the method of funding could be different in different cases. This could be done by creating a badge, or other graphical element connected to the network, which funding actors are allowed to use in official statements and other relevant occasions.

The optimal solution from a company perspective, which has been indicated by company interviewees, would be the possibility to co-finance projects as they appear. Hence, no commitment has to be made in order to join the network. Using this method, one pre-requisite for joining the

network could be that the company has to implement an energy management system according to ISO 50001, or have conducted energy audits or a well performed SEEMP depending on the type of company. However, due to reasons for co-financing methods according to the Energy Agency, this option is not possible.

Network members (funding actors)

In order to start the network, the Energy Agency will need a core group of companies that commits to funding the network with at least 60 % of the projects funding. This means that the Energy Agency will not be able to fund the network until a core group of companies commit to joining the network and thereby contributing to a program fund, which is to be operated by the network secretariat. This fund, however, can be financed on a year-by-year basis meaning that the funds must be delivered to the fund as projects progress during the program timeframe.

Extended network (non-funding actors)

The need for funding the network as a basis for joining puts a great strain on smaller companies and companies that have difficulties meeting positive financial results. Since these companies might be the ones that are most in need of getting project financing, or at least the possibility to join the network for discussions, this constitutes a major problem. Energy efficiency measures could also potentially boost their financial situation enough to reach sufficient profitability. This problem should be addressed by letting companies that do not have the possibility to commit to funding the network from start still be able to join projects started by the network, or even propose projects to the network and join in network meetings when issues concerning them should be discussed.

These companies should be identified as being part of the extended network, and have ongoing discussions with the network coordinator regarding their possible participation in network meetings and projects. It is then up to the executive board to assess whether these external companies could get project funding as well. The external funds will not be matched by the funds supplied by the Energy Agency and therefore any external companies joining projects will reduce the 40 % share that the Energy Agency commits from the start. However, if there is a large interest from external companies and if they see the need for the network, they are welcome to co-finance an upcoming program timeframe for the network, hence increasing the total amount of funds available to all companies. It is therefore a positive aspect letting external companies join network meetings and let them propose project ideas as well.

Funding the network

Based on the need for a core group of companies to fund the network, there are three main options of funding the network. These options consist of:

→All companies willing to join and willing to participate in projects fund the network with an equal amount of money per year.

→Companies that want to join fund the network based on their relative earnings/turnover/energy use per year, or some other metric.

→Companies that want to join the network fund the network according to their own will. They can fund as little as 10.000 – 50.000 SEK per year, or as much as an unlimited amount. It is up to the companies that form the core group to decide who pays what.

All these proposals do not exclude more funding to come at a later stage, but it is imperative from the Energy Agency's perspective that a certain amount of money is allocated to the network from startup. The Energy Agency will add 40 % co-financing to the network based on the amount of money that the companies allocate from the start. If more companies join during the program period, that will only add on to the co-financing made by the companies and will not generate any extra money from the Energy Agency.

Option 1, all companies pay the same amount, can be seen as the most equal in terms of funding the network, but it might generate problems when conducting projects, since small companies will not be able to propose as many project ideas as large companies. Hence, larger companies might be able to draw on their size and attain a larger share of financed projects. This will benefit the larger companies at the expense of the smaller companies, which counteracts the purpose of starting a network where the smaller companies are identified as having larger financial problems and smaller possibilities to conduct projects.

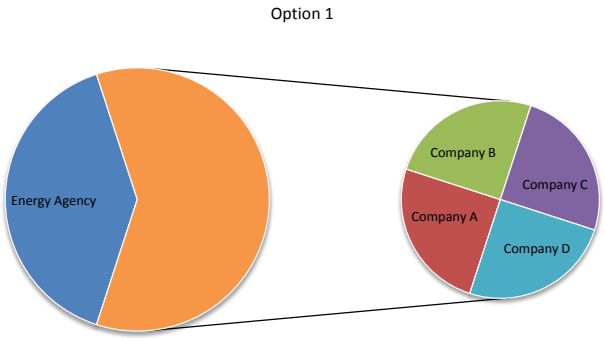

Figure 8: Company co-financing of the network. Option 1 shows an equal co-financing from all participating companies.

Option 2, where companies pay according to a set metric, would be fairer from a company perspective, since smaller companies will pay according to their size. However, depending on the metrics chosen, a company with small revenues might have huge energy consumption, which makes the metric important. A company with large emissions but small revenues will still have problems initiating projects and might not be able to fund the network corresponding to their emissions, even though they might need to decrease emissions greatly. When conducting projects, this method might be fairer since smaller companies will be able to attain funding for projects corresponding to their size.

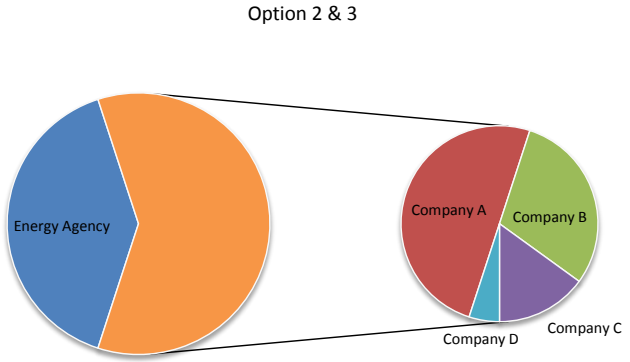

Figure 9: Option 2 & 3 shows a co-financing scheme where the companies joining the network co-finances the network either by an amount proportional to their revenue, or by a self-defined contribution.

Option 3, where companies can fund the network with an arbitrary amount, is a more relaxed version of option 2, where companies either support the network with as much money they see fit, or where different metrics are used for different companies. One could imagine a network where there is a differentiation between the funding depending on the

type of company, since the network should be open to all companies that have the possibility to address energy efficiency in the maritime industry. However, this option could open up for companies to utilize the network funds for projects, but fund the network with less funds than possible, creating tension between funding companies. Hence, this option is not the most optimal.

However, a mix of option 2 & 3, where the funding is based on what type of company that joins, and different levels of funding depending on the company size and its possibility to conduct projects could be relevant.

Funding the network should be made on a program basis, where the Energy Agency decides to fund the network for a specified amount of time, usually for three to five years. Depending on the amount of companies joining, this should be decided by the companies when initiating the network. If option 2 is used and a metric for energy efficiency is used as basis for funding the network, this could make it possible for companies that make large efficiency measures during the first three to five years of the network to get a lowered funding deal, since they have performed well, when the next program period should be decided.

FUNDING PROJECTS

On the matter of what projects the network should be able to fund, there should be no clear distinction. It should be up to the executive board of the network to decide, but projects should reduce energy use. Hence, all projects resulting in a lowered energy use per transported cargo or maritime operation could be funded and approved by the network.

It could be up to the network to state that a certain amount of money should go to each type of industry segment that joins the network, e.g. if Sweref (Sw: Skärgårdsredarna) companies join with a small amount of money, they should be allocated parts of the network funds for projects related to their segment and a specific meeting should be organized to cater for the discussions regarding companies in that segment. Hence the money could be earmarked for specific areas within the network, but this does not have to be very rigid. It just shows that when a specific segment is up for discussion, companies in that segment should be active in promoting their project ideas and discuss their difficulties.

The network should be able to address issues that are of environmental concern to Sweden and globally, i.e. NO_x, SO_x, and PM, as well as CO_2 have an impact on Sweden, while as CO_2 is the main important emission globally. However, an environmental effect resulting from energy use can be both global and local which means that from an energy efficiency point of view the network should be able to address all issues that reduce energy use, since they reduce emissions from both CO_2, NO_x, SO_x and PM wherever they occur. This means that domestic and international companies operating in Sweden should be able to join the network and bring forth projects connected to energy efficiency if they have business that affect Sweden, i.e. transporting goods to and from Sweden. From a societal point of view and from the perspective of increasing the competitiveness of Swedish companies abroad, energy efficiency measures that Swedish companies make on their fleets that operates on trades far from Sweden should also be able to get project funding, since they affect the global environment, as well as the local economy.

AIM AND OBJECTIVES OF THE NETWORK

One important aspect of a network for energy efficiency in the maritime industry is to create a relevant aim, or vision, and clear objectives that strive for achieving the aim for the network. The aim should visualize the long term goals for the network and for the network members. Hence, the aim should be vague enough to be inclusive, and specific enough to give some form of guidelines for the network and network members to strive for. The aim should be attainable, but in a long term perspective which enables the possibility to map a couple of objectives which should emphasize the work that has to be done within the network. Below is one aim presented as an alternative, but it should be up to the core companies, the executive board and the Energy Agency to formulate the aim of the network.

Aim

→Shipping should be the most efficient and environmentally friendly mode of transportation, and maritime operations should be carried out at the most efficient way possible by Swedish companies, and companies operating in Sweden.

This aim focus on the long-term goal of making shipping the number one choice for transporting goods, and it also focuses on making other maritime operations more energy efficient. The aim also sets the geographical limit to which companies that can get support, which through the aim is identified as Swedish companies operating anywhere in the world, and international companies operating in Sweden. Hence both global and local emissions as well as global and local social issues are handled by the network.

Objectives

The objectives of the network should show a clear path of how to reach the long-term aim of the network. This can be done by stating objectives such as setting a goal for the annual energy reduction attained through the network, or by setting objectives to how much energy reduction should have been achieved at the end of the first program period, i.e. after three to five years of operating the network.

The objectives should be decided by the companies in the network and the executive board in order to get a clear industry backing of the objectives. These objectives should be a start to help the network members to lower emissions to the levels decided by the European Commission and other international organizations.

Overall, transportation where shipping is one part of a transport chain, from producer to customer, should aim at being operated in the most energy efficient way possible. Shipping has a huge potential for being the most efficient and environmentally friendly mode possible, both for long-range transportation, short sea shipping and domestic transportation. This possibility should be embraced by the network for energy efficiency in the maritime industry.

ROUTE FORWARD

IN ORDER TO CREATE A NETWORK FOR ENERGY EFFICIENCY IN THE MARITIME INDUSTRY

In order to establish a network for energy efficiency in the maritime industry a group of companies must agree on co-financing the network. The Energy Agency have stated that the amount of funding the network can receive will be based on the amount of money that is supplied by industry partners, which means that there is no set limit for how much money the network can address. In practice, there will of course be a limit, and a valid amount of co-financing funds would be in the order of 10 million SEK per year, which would result in a total funding of 16.6 million SEK per year, due to the Energy Agency being able to finance 40 % of the total funds, which in the case of 10 million SEK per year company funding would result in 6.6 million SEK per year.

The executive board is the first part of the network which is needed to be formed. The two main ways of assigning a board to the network have been presented above, and it is up to the funding companies in collaboration with the Energy Agency to decide on an executive board.

The next focus would be to set up the network coordination, where a person should be hired or allocated from the organizations which will be in charge of the coordination to start working together with the network companies and network partners.

BOX 5

In order to start the network for energy efficiency in the maritime industry, four main things need to be done:

1. Form a core group of companies that are willing to support the network both with time and financial resources. The financial resources these companies commit to the network will be the basis for the financing supplied by the Energy Agency.
2. Appoint an executive board that will be responsible for the network.
3. Apply for funding from the Energy Agency based on the co-financing that the companies in the core group can provide. The network could apply for funding for a three-, four- or five-year period, based on how long time it should take until new companies can be able to join the core group. If a large amount of companies commit to funding the network, there could be grounds for applying for long term funding, but if just a few companies commit to funding the network, then a shorter time frame is more appropriate.
4. Propose a location for the coordinator and secretariat. It is not up to the executive board to decide where the coordinator or secretariat should be placed, since this is a matter of procurement for the Energy Agency. Though, the proposal that the board gives to the Energy Agency is very important for the decision made by the Energy Agency. However, it should be up to the network companies to come to a consensus on where to place the coordinator based on which coordination function best serves the network and the maritime industry as a whole.

CONCLUSION

The need for a focused approach to energy efficiency in the maritime industry is large and it is needed right now. The network for energy efficiency in the maritime industry should take a broad approach and cover the entire chain of operation for transporting cargo or other maritime operations. Hence, all stakeholders that have projects that reduce energy consumption in the maritime industry should be able to join the network.

The network should focus on reducing energy consumption in the most cost effective way possible, hence projects that lie just outside the current feasibility range, since they are too difficult or too expensive, should be chosen. The network should enhance the knowledge and competence in the industry by addressing joint issues and letting people working with energy efficiency and related matters discuss these issues in a structured manner with people working on similar issues in other companies.

The network should fund projects that benefit the industry as a whole in order to strengthen the Swedish maritime industry. Increasing the energy efficiency of Swedish companies will make them more competitive on a global market, and making companies that transport goods to and from Swedish ports more efficient also reduces emissions in a local and global perspective, which increases the overall environmental performance of the industry.

BOX 6

The main conclusions are:

1. There is a need for a network for energy efficiency in shipping. This network should address two main objectives:
   a. Increase the knowledge regarding energy efficiency and energy efficiency measures in the industry, from suppliers and cargo owners, to ports and ship owners, charterers and ship brokers alike.
   b. Initiate energy efficiency projects that benefit the industry as a whole, by either helping technologies or methods that are close to market introduction, or have difficulties proving its worth due to high or uncertain costs.
2. The network should focus on arranging network meetings on specific topics defined by industry partners. It is the job of the network coordinator to manage these network meetings, so that they address topics that are of relevance to the industry as a whole. The network meetings form the basis for initiating projects.
3. Discussions on joint problems regarding energy efficiency should benefit the industry as a whole hence information dissemination is of key importance in the network. Projects conducted by the network should be thoroughly recorded and the estimated energy savings should be followed by actual measuring or follow up statistical data. It is important that an overall research project is initiated to look at the potential benefit of the savings made by several companies. Hence, conclusions can be drawn to see which energy reduction schemes are the most beneficial for the involved companies, which in turn will give guidance for other companies to follow suite.
4. A long term goal should be that Swedish companies operating in the maritime industry should be market leaders when it comes to energy efficiency.

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