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Initiatives in Swedish private sector to conserve and sustainably use the oceans, seas and marine resources for sustainable development

Preparations for the UN Ocean Conference in June 2017

Commissioned by The Swedish Agency for Marine and Water Management

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Summary

The Swedish Agency for Marine and Water Management (SwAM) has been commissioned by the Ministry of the Environment and Energy to contribute to preparations for the UN global Ocean Conference on Sustainable Development Goal (SDG) 14¹ in New York June 5-9, 2017. This preparatory assignment includes compilation of supporting material for 7 partnership dialogues to be held at the meeting, along with summaries of successful and promising initiatives from Sweden that are expected to contribute to achieving the SDG targets with special focus on SDG 14.

This report summarizes a number of such initiatives from the Swedish private sector, including traditional industry and blue growth companies. Identification of initiatives has been done in dialogue with companies and representatives from industrial sectors. The dialogues have, in addition to the specific initiatives, also provided an overall insight in strengths and opportunities for industry and blue growth companies to contribute to achievements in SDG 14.

A long-term purpose of this study is to summarize these strengths to provide a basis for the strategic planning of activities to fulfil the sustainability goals in a national and international perspective.

Swedish industry has a long history of environmental awareness. The national environmental quality objectives, which were put into force 1999, have to a large extent contributed as a driving force for environmental initiatives. Measures that are and have been implemented to contribute to the environmental quality objectives *A Non-Toxic Environment, Zero Eutrophication, A Balanced Marine Environment, A Rich Diversity of Plant and Animal Life* and *the Generation Goal* are also of importance for the achievements for SDG 14. Experiences from these initiatives such as technical development, co-operational structures etc. are important assets for the ambitions with the 2030 agenda.

The main strengths and opportunities for Swedish industry to contribute to achievements in SDG 14 can be summarized, using information collected in the dialogues in this assignment, in the following areas:

¹ Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Long term partnerships and co-operation

There is a tradition and history in Sweden of developing environmental performance in co-operation and partnership. A basis for partnership and cooperation is an open dialogue. Knowledge can be shared and available resources (man power and financial) can be used in an efficient way to enforce environmental improvements. An important component is a democratic way of working and co-operation, including openness in use of data and communication. Another important component in successful co-operation is long term commitment. With long term objectives and a common time plan, efficient development can be achieved.

System perspective

System perspective is also an important basis in Swedish environmental management. Approaching an environmental problem with a system perspective, i.e. viewing the problem at hand in a broader perspective, when defining solutions, ensures that the measures taken do not have negative consequences on other issues. Key factors for approaching problems with a system perspective is knowledge and understanding of the system and how different parts contribute and depend on each other. A good example is the system perspective that has been used in the energy system, where many Swedish cities successfully have reduced use of energy resources by using residual heat from industries in district heating systems instead of e.g. developing a separate energy system for residential areas.

Vast experience of environmental measures and initiatives

Swedish industries have, since the environmental code was enforced in the 1960-ies, developed process optimizations and technological solutions to reduce emissions in order to minimize environmental impact. During later years these initiatives have been extended to also include actions to reduce environmental impacts in supplier, use and waste phases of the product life, and to increase the use of re-cycled raw materials in products

Innovation and development

Sweden provides good opportunities for development and innovation, both in existing industry and in new blue growth companies. Development and innovation include new technology for sustainable production or reduced emissions, new technology for fishery or new solutions for energy or food production from marine environments. Development also includes innovative digital solutions and sustainable business models with environmental awareness as an integrated part of the business concept.

Conclusions

Swedish industry has a long history of environmental awareness and successful environmental management. A large number of blue growth initiatives are under way to full scale establishment. In order to strengthen and enhance these achievements, further incentives are needed.

Some possible actions to enhance contributions in Sweden are

- Evaluate the need for changes in present environmental regulations – are they relevant and appropriate for introduction of innovative solutions and initiatives or are they delaying development?
- Increase incentives to move from innovation to market

Experiences of environmental measures in industry are often transferrable on an international basis and this is an area where Swedish private sector can contribute. Initiatives that today are done in industry on a regular basis in the context of sustainability; concerning the products' life-time environmental impact is already transferred to suppliers and users across the world.

Activities in partnership and co-operation and with a system perspective are very much dependent on culture and approach in the individual countries, which implies that it can be a success factor in some cases and not applicable in others. Having this in mind this area can also be an important strength for Sweden in contributing to the SDG14 on an international basis.

In order for Sweden to contribute to solutions internationally, an understanding of the local society is needed and adaptation of both decision making processes and technological solutions to the local situation. Improvements by technical solutions, such as process optimization, emission treatments or improved resource management cannot be implemented without knowledge of the processes for decision making in society and how decisions are implemented.

Some possible contributions from Sweden are:

- Knowledge transfer concerning "eco governance" – co-operation between authorities, between authorities and industry and within industry. Dialogue processes.
- Creation of market advantages for products and services that imply improved environmental performance – information, international agreements etc.

- Knowledge transfer concerning environmental performance in the value chain – system perspective.

1 Introduction

The Swedish Agency for Marine and Water Management (SwAM) has been commissioned by the Swedish Ministry of the Environment and Energy to contribute with preparations for the UN Ocean Conference on Sustainable Development Goal (SDG) 14² in New York June 5-9, 2017. This preparatory assignment includes compilation of supporting material for 7 partnership dialogs to be held at the meeting along with summaries of successful and promising initiatives from Sweden that are expected to contribute to the achieving of the SDG targets with special focus on the SDG 14. IVL was commissioned by SwAM to assist in the identification of initiatives from the Swedish private sector, including both traditional industry and blue growth companies. This report presents a list of private sector initiatives. A number of them are presented in short summaries in appendices. The report also summarizes competencies, experiences and other prerequisites in Swedish private sector that are advantageous in the ambitions to achieve the goal and targets within SDG 14.

2 Purpose of the study

The purpose of the study was to collect successful and promising initiatives from Swedish industry sectors. The purpose has also been to identify specific strengths of these sectors in their achievements and initiatives. These strengths are highlighted by providing examples of experiences from individual industries and industrial sectors in the appendices to this report. An additional purpose of this study was to summarize these strengths so that they can come in use in the strategic planning for achievements in fulfilling the sustainability goals in a national and international perspective.

The SDG goal and targets as well as Swedish priority focus areas and the 7 themes for partnership dialogues have formed the basis for this study.

For definitions of SDG 14 and targets, see <http://www.un.org/sustainabledevelopment/oceans/>.

² Conserve and sustainably use the oceans, seas and marine resources for sustainable development

The priority focus areas for Sweden in the Ocean Conference are:

- Marine litter and source-to-sea
- Sustainable use of resources for a blue economy
- Oceans and climate, including ocean acidification

For partnership dialogues arranged at the conference seven themes have been defined.

1. Addressing Marine Pollution
2. Managing, protecting, conserving and restoring marine and coastal ecosystems
3. Minimizing and addressing marine acidification
4. Making fisheries sustainable
5. Increasing economic benefits to SIDS and LDCs and providing access for small-scale artisanal fisheries to marine resources and markets
6. Increasing scientific knowledge, and developing research capacity and transfer of marine technology.
7. Enhancing the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea

3 Methodology

Identification of initiatives has been made in dialogue with industry and representatives from industrial sectors, both traditional industry and new blue growth companies. Dialogue has been held through

- personal contacts with representatives from Swedish trade and industry
- a workshop with representatives from private sector, academia and authorities

The information that is reported in the following sections 4, 5 and 6 are compiled from these dialogues. The concluding section 7 includes a summary and discussion from IVL point of view of priority areas for Swedish industry to contribute to the SDG 14.

The study has been performed in close cooperation with Swedish Agency for Marine and Water Management (SwAM).

4 Workshop

A workshop was held March 21 in Göteborg with representatives from industry, blue growth companies academia and authorities (see appendix 1 for list of attendees and workshop agenda). The meeting included short presentations of initiatives from Swedish industry and blue growth companies. In groups, the attendees discussed

1. Are there additional specific examples of successful/promising initiatives?
2. In addition to the initiatives, what are the opportunities and strengths in the Swedish private sector to contribute to the goal?
 - In Sweden?
 - In an international perspective?
3. What are the main obstacles for successful initiatives?

The workshop resulted in a number of opportunities and strengths in Sweden and Swedish industry in contributing to SDG 14. Some examples from the discussions are presented in figure 1³.

The workshop also resulted in a number of specific identified initiatives. These are presented in the following section.

³ The discussion also resulted in suggestions for how Sweden can contribute in a broader perspective than just from the industrial sectors. This is also included in figure 1.

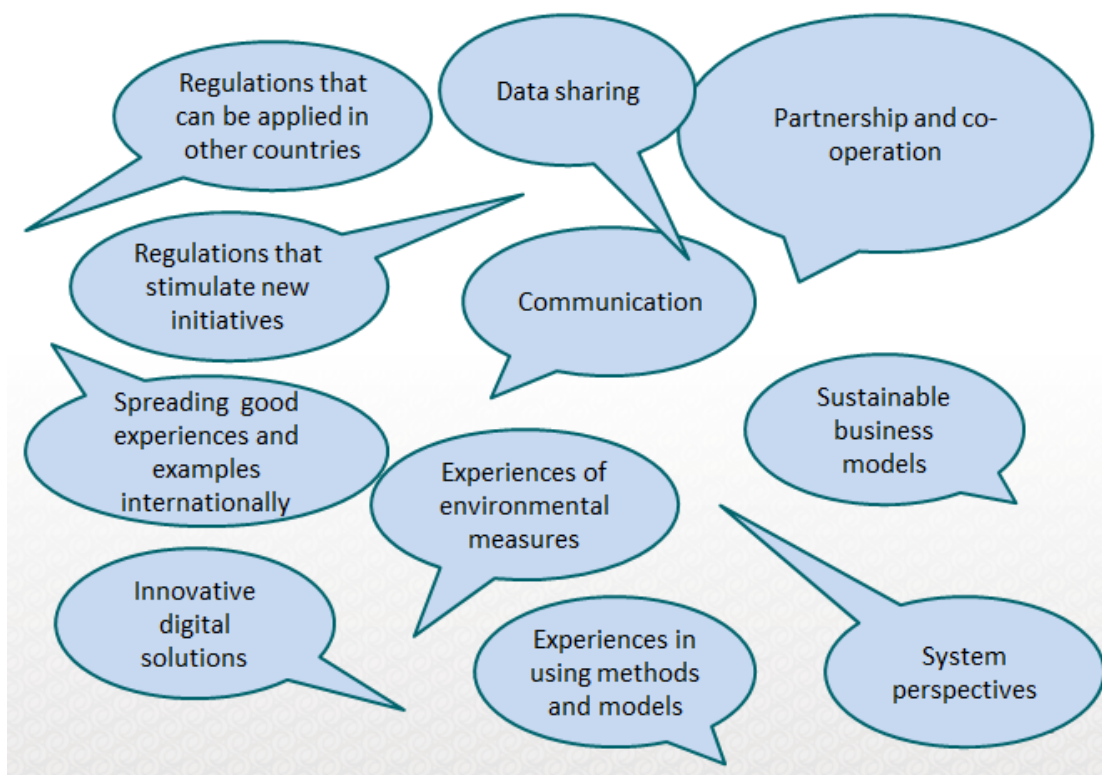


Figure 1 Identified strengths in Sweden that can contribute to achieving SDG 14. From discussions at workshop March 21, Göteborg

5 Identified initiatives

The list in table 1 on the following pages includes initiatives identified in the dialogues. For each initiative, we have indicated the most relevant targets within SDG 14 and partnership dialogues, where we believe the initiatives can contribute. This has been done by correlating the objective of the initiative with the target. Most of the initiatives are also of relevance for other SDGs, but this is not included in the following list.

The list is not comprehensive, but includes examples highlighted in our dialogues.

The list of initiatives was used as a basis for selection of examples to be presented more in detail in appendices. This selection was done in order to highlight the strengths of Swedish private sector in the contribution to SDG 14. The selected examples are presented in table 2.

Table 1 List of identified initiatives

Organisation	Initiative	Target	Partnership dialogue
Steel Industry			
SSAB ⁱ	Long-term partnership for recipient monitoring provides information regarding environmental impact that forms a basis for assessment of measures and actions	14.1, 14.2	1, 2
Partnership SSAB, LKAB Vattenfall ⁱⁱ	Partnership for innovation and research towards fossil-free ironmaking –.The project's goal is to come up with a process that emits water instead of carbon dioxide by using hydrogen instead of the current procedure that's based on blast furnaces burning coal and coke.	14.3	3
Höganäs AB , Alnarp Cleanwater AB, NCC, KTH, Örebro University ⁱⁱⁱ	Partnership in resource efficient water purification utilizing mineral-based by-products from the Swedish steel and metal industries. The project is a valuable example of circular economy and industrial symbiosis by utilizing a by-product to reduce the transfer of phosphorus and metals to oceans and lakes.	14.1	1
Höganäs AB ^{iv}	Development of innovative technology to achieve clean drinking water for everybody by using porous iron powder	14.1	1
Swedish Steel Yachts AB, Sandvik Materials Technology AB, Outokumpu Stainless AB, ABB, AGA Gas, SAAB Kockums AB, Saab AB, Scania AB. ^v	Partnership for innovative technology development to achieve maintenance-free and everlasting boats resulting in a reduced impact on marine environment: reduced need for antifouling and lower fuel consumption.	14.1, 14.3	1, 3
Outokumpu Stainless AB, Uddeholms AB, Höganäs AB, and SSAB ^{vi}	Partnership for increasing biodiversity and strengthening resilience in land-sea areas on site– a Swedish initiative to create a natural environment on industrial sites	14.2	2

Organisation	Initiative	Target	Partnership dialogue
Pulp and Paper industry			
Pulp and paper industry ^{vii}	50 years of environmental measures. By interaction between industry, authorities, and scientists, substantial improvement in receiving waters has been achieved	14.1, 14.2	1, 2
SEKAB/Domsjö Biorefinery ^{viii}	Use of forest products for sustainable production and increased resource efficiency	14.1,	1
Chemical Industry			
Borealis AB ^{ix}	Plastic industry acts to prevent plastic pollution and promote recycling.	14.1	1
AkzoNobel ^x	Development of new antifouling paint to reduce friction and risk of invasive species	14.1,	1, 6
Waste Water Treatment			
IVL ^{xi}	Separation of micro plastics in waste water treatment	14.1	1
Ecofiltration Nordic AB ^{xii}	Recycling of phosphorus from wastewater	14.1, 14.7	1, 6
Hammarby Sjöstadswerk ^{xiii}	Development of municipal waste water treatment	14.1	1
IVL, KTH, SYVAB, Stockholm Vatten ^{xiv}	Systems for the purification of pharmaceutical residues and other priority persistent substances	14.1	1
Manufacturing Industry			
Atlas Copco SIMSmining EU project ^{xv}	Development of sustainable mining systems, several participating companies	14.1, 14.3	1, 3
Alva Laval ^{xvi}	Scrubbers for reduced emissions from ships	14.1, 14.3	1, 3
Electrolux ^{xvii}	Initiative for reduced littering	14.1	1
Tretorn ^{xviii}	Recycled fishing nets are reused to produce rainwear	14.1	1

Organisation	Initiative	Target	Partnership dialogue
Energy			
CorPower Ocean AB ^{xix}	Development and testing of efficient wave power	14.1, 14.7	1, 6
Seabased ^{xx}	Development of wave power	14.1, 14.7	1, 6
Möln dal Energi AB ^{xxi}	Measures to facilitate eel migration in Möln dalsån	14.1	2
Fishing industry			
The Fish Auktion in Smögen, Nordic Fishermen's Association, Rambo AB, Plastix A/S, Municipalities, Swedish Agency for Marine and Water Management ^{xxii}	Fish industry partners collaborate to remove and recycle marine plastic debris	14.1, 14.7	1, 4
FF Norden ^{xxiii}	Recycling of fishing gear, developed selective fishing gear for reduced environmental impact	14.1, 14.4, 14.7	1, 4, 6
Agriculture and food industry			
Joint-venture between the Swedish Board of Agriculture, The Swedish Federation of Farmers and 17 regional municipalities in southern and middle Sweden ^{xxiv}	Focus on Nutrients – Advisory services for reduced environmental impact from farming	14.1	1
Fazer ^{xxv}	Actions to reduce nutrient load on waters	14.1, 14.2	1,2
Fazer ^{xxvi}	Nudging to influence consumer choices to more sustainable foods	14.1, 14.2	1,2

Organisation	Initiative	Target	Partnership dialogue
Blue Growth			
Simris alg ^{xxvii}	Cultivation of algae for use as a food supplement	14.7	6
Marin Biogas ^{xxviii}	Farming of sea squirts (<i>Ciona intestinalis</i>) for biogas production and as a nutrient catch crop	14.1, 14.3	1, 6
Vega-fish ^{xxix}	Land based cultivation of shrimp	14.4, 14.6, 14.7	4, 6
Smögenlax Aquaculture AB ^{xxx}	Land based Aquaculture, salmon production. Integrated production site	14.1	4, 6
Swedish algae factory ^{xxxi}	Using inherent features of microalgae to improve water quality and reduce fossil dependence	14.3, 14.7	6
Flocazur AB ^{xxxii}	Technology for water treatment in aquaculture applications	14.1, 14.7	4, 6
Rena hav AB ^{xxxiii}	Production of biogas and nutrients from fishery waste	14.7	4, 6
Lantfisk AB ^{xxxiv}	Land based fish cultivation	14.4, 14.7	4, 6
Musselfeed ^{xxxv}	Cultivation of mussels as catch crop for nutrients. Production of mussel flour as protein source or animal feed.	14.1 14.7	1, 6
Svensk gårdsfisk ^{xxxvi}	Landbased Aqua culture	14.4, 14.7	4, 6
Ostrea Aquaculture ^{xxxvii}	Cultivation of oysters	14.4, 14.7	4, 6
Scanfjord ^{xxxviii}	Cultivation of mussels	14.4, 14.7	4, 6

Organisation	Initiative	Target	Partnership dialogue
Shipping & Ports			
ABB Marine, HH ferries ^{xxxix}	Electrification of ferry-line	14.1, 14.3	1, 3, 6
Zero Vision Tool ^{xl}	An industry driven PPP (triple helix) for a safer, more environmentally, climate and energy efficient while still profitable, transport at sea	14.1, 14.2, 14.3	1, 3, 6
Orust e-boats ^{xli}	Energy efficient hulls, electric powering	14.1, 14.3	1, 3
Clean Shipping Index ^{xlii}	Environmental rating scheme which ranks ships and carriers according to their environmental performance	14.1, 14.3	1, 3
Båtskroten ^{xliii}	Sustainable dismantling and waste management of boats	14.1	1
CMI Marine AB ^{xliv}	Equipment for oil remediation	14.1, 14.2	1, 2
FF Norden ^{xlvi}	Recycling of fishing gear, developed selective fishing gear for reduced environmental impact	14.1, 14.4, 14.7	1, 4, 6
Wärtsilä AB, IVL, partners in Lithuania and Finland, ^{xlvi}	ZEB; Zero emissions in the Baltic Sea. oily water separation and development of existing technologies BONUS project	14.1, 14.3 14.7	1,2, 3, 6
Port of Göteborg ^{xlvi}	Restauration of eelgrass beds	14.2	2
Port of Göteborg & Swedegas ^{xlviii}	Promoting the use of LNG as a marine fuel, Infrastructure for LNG -use	14.1, 14.3	1, 3
Port of Göteborg ^{xlvi}	On-shore power supply for vessels	14.1, 14.3	1, 3

Organisation	Initiative	Target	Partnership dialogue
Tourism			
Catxalot ⁱ	Marketing of edible seaweed and wrack. Courses in harvesting and cooking, Maritime food tourism	14.7	6
Fishyourdream AB ⁱⁱ	Fishing tourism with environmental focus	14.4	4
Kosterhavets national park ⁱⁱⁱ	Co-operation between fishing industry and tourism	14.2, 14.7	2
Other partnerships and platforms			
Organisation	Initiative	Target	Partnership dialogue
Innovatum ^{liii}	Science park for development of innovations to business	14.1, 14.3, 14.7	1, 3, 6
Test site Skagerak ^{liv}	Testing facility for marine energy	14.1, 14.7	1, 6
Marine Center Simrishamn ^{lv}	Innovation platform, research and business solutions with focus on marine litter, sustainable fisheries and marine pedagogy	14.1, 14.4 14.7	1, 4, 6
Hagainitativet ^{lvi}	Network of companies for active climate responsibility	14.1, 14.3	1, 3
Swedish Leadership for Sustainable Development ^{lvii}	A network of more than 20 participating companies	14.1, 14.3	1,3
Maritima Klustret ^{lviii}	Collaboration for increased innovation and business development in the maritime sector of west Sweden.	14.1, 14.3, 14.7	1, 3, 6

Table 2 List of initiatives presented in appendices

Appendix	Organisation/Sector	Initiative	Motivation
2	Steel industry	Long-term partnership for recipient monitoring	Addressing marine pollution. Example of long term partnership
3	Agriculture	For more than 15 years, the joint venture Focus on Nutrients has delivered advice for agriculture and reduced environmental impact	Addressing marine pollution. Example of long term partnership
4	Pulp and paper industry	50 years of environmental measures. By interaction between industry, authorities, and scientists, substantial improvement in receiving waters has been achieved	Addressing marine pollution. Swedish focus area; Source to sea Example of experience of environmental measures and long—term partnership
5	Fish industry	Collaboration to remove and recycle marine plastic debris	Swedish focus area; Marine litter. Example of long term partnership
6	Shipping	A long-term cooperation for a safer, more environmentally, climate and energy efficient, transport at sea	Swedish focus area ; Ocean acidification, Example of long-term partnership and development and innovation
7	Blue Growth	Circular land-based salmon production	Swedish focus area; Sustainable use of resources for a blue economy Example of development and innovation
8	Blue Growth	Farming of Sea squirts for biogas production and as a nutrient catch crop	Swedish focus area; Sustainable use of resources for a blue economy Example of development

			and innovation
9	Waste management	Partnership for reducing plastic waste	Swedish focus area; Marine litter. Example of system perspective
10	Chemical Industry	Plastic industry acts to prevent plastic pollution and promote recycling.	Swedish focus area; Marine litter. Example of experience of environmental measures
11	Waste water treatment	Systems for purification of pharmaceuticals and other priority substances	Swedish focus area; Source-to-sea. Example of experience of environmental measures
12	Shipping	Electrification of ferry-line	Swedish focus area ; Ocean acidification, Example of experience of environmental measures
13	Blue Growth	Using microalgae to improve water quality and reduce fossil dependence	Swedish focus area; Sustainable use of resources for a blue economy. Example of development and innovation
14	Energy	Development of a converter for highly efficient wave energy generation	Swedish focus area; Ocean acidification and sustainable use of resources. Example of development and innovation

6 Swedish industry strengths in achieving SDG 14

Swedish industry has a long history of environmental awareness. The national environmental quality objectives, which were put into force 1999, have to a large extent contributed as a driving force for environmental initiatives. Measures that are and have been implemented to contribute to the environmental quality objectives *A Non-Toxic Environment, Zero Eutrophication, A Balanced Marine Environment, A Rich Diversity of Plant and Animal Life* and *the Generation Goal* are also of importance for the achievements for SDG 14. Experiences from these initiatives such as technical development, co-operational structures etc. are important assets in the ambitions with the 2030 agenda⁴.

Many Swedish companies develop, produce and sell products with a high environmental profile. Environmental initiatives and measures performed by the individual companies contribute to environmental advantages in Sweden and other parts of the world where the products are used⁵. Environmental measures are introduced to reduce environmental impact in all stages of the product and service life cycle.

Sweden also has a long history of innovation and turning ideas and technological development to profitable business solutions. This is an advantage in the 2030 agenda efforts. A basis for this is technical and innovative skills connected to a business approach. In addition there is an infrastructure of support for development of ideas to business (both financial and knowledge-wise) that favors this development.

The main strengths and opportunities for Swedish industry to contribute to achievements in SDG 14 can be summarized, using information collected in the dialogues in this assignment, in the following areas:

- Long term partnerships and co-operation
- System perspective
- Long experience of environmental measures and initiatives
- Innovation and development

⁴ pers. comm Annika Helker Lundström, Nationell miljömålssamordnare för näringslivet.

⁵ <http://www.miljomal.se/Vem-gor-vad/Naringslivet/Sa-jobbar-naringslivet-med-miljoarbetet/>

Each area is described in short in the following sections. In addition to the above listed areas, Sweden's regulatory system and implementation has also been brought up as an important advantage. This area is not an initiative from industry and is therefore not included in the list. A short text regarding views on the regulatory area is however included.

6.1 Long term partnership and co-operation

There is a tradition and history in Sweden of developing environmental performance in co-operation and partnership. This includes co-operation between

- Companies and authorities
- Companies and academy/universities
- Companies within a business sector or in several business sectors

Co-operation can also be on an international basis.

A basis for partnership and cooperation is an open dialogue. Knowledge can be shared and available resources (man power and financial) can be used in an efficient way to enforce environmental achievements. An important component is a democratic way of working and co-operating, including openness in use of data and communication. These criteria are of course also important for achievements related to SDG 17 and others.

Another important component in successful co-operation is long term commitment, both between the participating parties and to the joint goals and visions for the co-operation. Long term commitments can provide confidence which will form a basis for an open and creative dialogue. With long term objectives and a common time plan, efficient development can be achieved.

Some identified initiatives in this area are given in the following table and included as a short summary in appendices.

Table 3 Examples of initiatives including long term partnership and co-operation

Organisation	Initiative	Appendix
SSAB	Long-term partnership for recipient monitoring provides information regarding environmental impact that forms a basis for assessment of measures and actions.	Appendix 2
Joint-venture between the Swedish Board of Agriculture, The Swedish Federation of Farmers and 17 regional municipalities in southern and middle Sweden	For more than 15 years, the joint venture Focus on Nutrients has delivered advice for agriculture and reduced environmental impact	Appendix 3
Pulp and paper industry	50 years of environmental measures. By interaction between industry, authorities, and scientists, substantial improvement in receiving waters has been achieved	Appendix 4
The Fish Auktion in Smögen, Nordic Fishermen's Association, Rambo AB, Plastix A/S, Municipalities, Swedish Agency for Marine and Water Management	Fish industry partners collaborate to remove and recycle marine plastic debris	Appendix 5
Zero Vision Tool (Swedish Ship owners' Association, Association Ports of Sweden, Swedish sustainable Shipping AB and representing the Finnish Maritime Cluster; Finnish Ship owners' Association and Finnish Port Association.)	A long-term cooperation for a safer, more environmentally, climate and energy efficient, transport at sea	Appendix 6

6.2 System perspective

System perspective is an important basis in Swedish environmental management. The system perspective in the context of this report implies that the solution to an environmental problem is not approached with narrow approach focusing solely on the part of the system where the specific problem is located. The problem as

well as the potential solutions must be regarded is a broader perspective also including other linked systems and processes to ensure that a solution to one problem does not cause other problems elsewhere and to evaluate potential cost efficient solutions outside the specific location of the problem. By using a system perspective, the most efficient measures can be used in order to tackle an environmental problem. A good example is the system perspective that has been used in the energy system, where many Swedish cities successfully have reduced use of energy resources by using residual heat from industries in district heating systems instead of focusing on developing independent heating systems for the residential sector. System perspective is very closely connected to co-operation and partnership, described in the previous section. At the workshop, the Swedish system for waste treatment was mentioned as a good example and initiative that can contribute to SDG 14.

An important basis for the system perspective is knowledge and understanding of the system and how the different parts contribute and depend on each other. For example, an enhanced waste water treatment may reduce emissions but may also imply increased use of energy and chemicals. Other solutions such as up stream measures can potentially provide the same positive effect with higher cost and resource efficiency.

Development and use of common methods and models for system analysis (e.g. Life Cycle Assessment) is important.

Some identified initiatives in this area are given in the following table and included as a short summary in appendices.

Table 4 Examples of initiatives including a system perspective

Organisation	Initiative	Appendix
Smögenlax Aquaculture AB	Circular Land based salmon production Production site is integrated with food and energy production	Appendix 7
Marin Biogas AB	Farming of sea squirts (<i>Ciona intestinalis</i>) for biogas production and as a nutrient catch crop enables reduced eutrophication and use of fossil fuels	Appendix 8
Avfall Sverige	Participation in ISWA Task Force on Marine Litter	Appendix 9

6.3 Vast experience of environmental measures and initiatives

Swedish industry has a long history of environmental awareness. Companies have, since the environmental code was enforced in the 1960-ies, developed process optimizations and enforced reductions of emissions in order to reduce environmental impact. During later years these initiatives have been extended to also include actions to reduce environmental impacts in supplier, use and waste phases of the product life, and to increase the use of re-cycled raw materials in products

Some identified initiatives in this area are given in the following table and included as a short summary in appendices.

Table 5 Examples of initiatives including environmental measures

Organisation	Initiative	Appendix
Pulp and paper industry	50 years of environmental measures. By interaction between industry, authorities, and scientists, substantial improvement in receiving waters has been achieved	Appendix 4
Borealis AB	Plastic industry acts to prevent plastic pollution and promote recycling.	Appendix 10
KTH, SYVAB, Stockholm Vatten, IVL	Systems for the purification of pharmaceutical residues and other priority persistent substances	Appendix 11
ABB Marine, HH ferries	Electrification of ferry-line	Appendix 12

6.4 Development and innovation

Sweden provides good opportunities for development and innovation, both in existing industry and in new blue growth companies. Development and innovation include new technology for sustainable production or reduced

emissions, new technology for fishery or new solutions for energy or food production from marine environments.

Development also includes innovative digital solutions and sustainable business models with environmental awareness as an integrated part of the business concept.

In many cases, partnership and co-operation form a basis for development and innovation.

Some identified initiatives in this area are given in the following table and included as a short summary in appendices.

Table 6 Examples of initiatives including development and innovation

Organisation	Initiative	Appendix
Smögenlax Aquaculture AB	Land based salmon production. Integrated production site	Appendix 7
Marin Biogas	Farming of sea squirts (<i>Ciona intestinalis</i>) for biogas production and as a nutrient catch crop	Appendix 8
Swedish algae factory	Using inherent features of microalgae to improve water quality and reduce fossil dependence	Appendix 13
Borealis AB	Plastic industry acts to prevent plastic pollution and promote recycling.	Appendix 10
CorPower Ocean	Development of a converter for highly efficient wave energy generation	Appendix 14

6.5 Regulations

Regulations are a driving force for development of environmental performance. Experiences of policies and regulations in Sweden could also be of use in an international arena. A good example in Sweden is for instance support for developing innovations to business and starting up of companies. The environmental code and the permitting process is also a driving force for the

development of environmental measures in new and existing industries. In the permitting process, Sweden has historically used benchmark values for emissions instead of limit values. This has provided a support to industries in their work to test and develop environmental measures⁶.

There are possibilities to further develop regulations that would enhance achievements in SDG 14. Some examples given at the workshop are

- Simplify permitting process for implementation of new technologies and innovations which contribute to SDG 14 targets.
- Economic incentives for catch crops (in analogy with land based cultivated grasslands)
- Enhance co-operation between existing industry and innovation companies – compensation measures - can a catch crop replace a measure for reduced emissions at an existing industrial plant?

Industrial companies and branch organizations only contribute on an indirect basis to the regulatory area.

7 Conclusions

In this section we summarize our view on in what manner Swedish Industry best can contribute to SDG 14. We have separated the presentation in two parts – Contributions in Sweden and contributions in the international perspective.

7.1 Contributions in Sweden

Swedish industry has a long history of environmental awareness and successful environmental management. A large number of blue growth initiatives are under way. In order to strengthen and enhance these achievements, further incentives are needed. At the workshop several representatives from industry pointed out that present regulatory system for environmental permits actually delays the developing of new blue growth solutions or testing of new environmental technology. This mainly because the current legislation is focused on e.g. specific emissions and available technologies to avoid these and not adapted to innovative solutions which have the potential to contribute to several SDG:s in an integrated manner.

Some possible actions to enhance contributions in Sweden are

- Evaluate the need for changes in present environmental regulations – are they relevant and appropriate for introduction of innovative solutions and initiatives or are they delaying development?
- Increase incentives to move from innovation to market

7.2 International contribution

Experiences of environmental measures in industry are often transferrable on an international basis and this is an area where we believe Sweden and Swedish industry can contribute. In addition, the initiatives that today are taken in industry on a regular basis in the context of sustainability; concerning the products' life-time environmental impact is already transferred to suppliers and users across the world.

Activities in partnership and co-operation and with a system perspective are very much dependent on culture and approach in the individual countries, which implies that it can be a success factor in some cases and not applicable in others. Having this in mind this area can also be an important strength for Sweden in contributing to the SDG14 on an international basis.

In order for Sweden to contribute to solutions internationally, an understanding of the local society is needed. Improvements by technical solutions, such as process optimization, emission treatments or improved resource management cannot be implemented without knowledge of the society processes and how these processes function.

Some possible contributions from Sweden are:

- Knowledge transfer concerning "eco governance" – co-operation between authorities, between authorities and industry and within industry as well as other stakeholders. Structured dialogue processes are an important part of e.g. dialogues between different stakeholder groups.
- Creation of market advantages for products and services that imply improved environmental performance – information, international agreements etc.
- Knowledge transfer concerning environmental performance in the value chain – system approach.

...and more specific:

- **Municipal waste water treatment (in combination of energy production and nutrient extraction), reuse of treated water.** Water scarcity and pollution of available water resources are globally increasing problems further aggravated by urbanisation, climate change and water pollution. Introduction of modern municipal waste water treatment can significantly reduce transfer of pollutants to recipients (freshwater and coastal waters) and also contribute to production of renewable energy (biogas), nutrient recovery and – in combination with additional measures – to water re-use by e.g. infiltration of purified water into groundwater reservoirs.
- **Shipping; treatment of emissions to air, treatment of ballast water.** The shipping sector is a key actor in facilitating global trade and will likely increase in importance in the future. In comparison to land-based sources of pollution, shipping has until recently to a large extent been unregulated. Modern technology can be applied to reduce emissions to air affecting ocean ecosystems and human health (e.g. particulates, sulphur dioxide). Modern technology is also the basis for more sustainable fuel use such as LNG or other low-sulphur fuels. Ballast water is a potential media for introduction of invasive species is transported and released under uncontrolled conditions. Again, technologies for treatment of ballast water can significantly reduce these potential problems.
- **Experiences from steel and pulp and paper industry – advanced treatment of emissions, efficient production processes, resource management.** Industrial production of steel and pulp and paper form the back bone of Swedish industrial growth. As industries have developed, emissions of pollutants to fresh- and coastal water recipients have been reduced drastically by improved process design and resource efficiency and by introduction of specific treatment steps for pollutants (metals, organic matter/fibres, organic pollutants and nutrients). Vast experience exists on technological solutions, target setting and regulatory development which can be transferred.

- **Transfer of knowledge of innovations in blue growth initiatives.**

Large efforts are currently underway in Sweden and elsewhere to develop and introduce sustainable marine innovations for e.g. energy (wind, waves), production of substrates for biogas and chemical industry, food production. International collaboration, knowledge transfer and exchange of experience can provide the necessary means to increase development from concept to commercially based operations and thus to enhance the development of sustainable blue growth and economic development of coastal communities. Knowledge exchange on both novel technologies as well as processes and policies/incitements for development and introduction of blue growth initiatives is here needed.

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- i Pers. comm Sophie Carler Jernkontoret
- ii Pers. comm Sophie Carler Jernkontoret
- iii Pers. comm Sophie Carler Jernkontoret
- iv Pers. comm Sophie Carler Jernkontoret
- v Pers. comm Sophie Carler Jernkontoret
- vi Pers. comm Sophie Carler Jernkontoret
- vii Per. Com Christina Wiklund, Skogsindustrierna
- viii <http://www.sekab.com/about-us/biorefinery/>
- ix Pers. comm Marie-Louise Johansson, Borealis
- x Pers. Comm Klas Hallberg, Akzo Nobel
- xi <http://www.ivl.se/sidor/publikationer/publikation.html?id=5240>
- xii <http://advantage-environment.com/workplace/natural-filter-media-for-phosphorus-recovery/>
- xiii <http://sjostad.ivl.se/>
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- xvii Pers. Comm Henrik Sundström, Electrolux
- xviii <http://advantage-environment.com/workplace/rainwear-from-recycled-materials/>
- xix <http://www.corpowerocean.com/>
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- xxv Pers. Comm Mariana Granström, Fazer
- xxvi Pers. Comm Mariana Granström, Fazer
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- xxxii <http://flocazur.com/>
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- xxxiv <http://lantfisk.se/index.html>
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- xxxvi <http://www.gardsfisk.se/>
- xxxvii <http://aquaculture.se/>
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- xxxix <http://advantage-environment.com/okategoriserade/pa-strom-over-oresund/>
- xl <http://www.zerovisiontool.com/>
- xli <http://www.orusteboats.se/>
- xl ii <https://www.cleanshippingindex.com/>
- xl iii <http://batskroten.se/>
- xl iv <http://www.cmimarine.se/>
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- xl viii <https://www.portofgothenburg.com/about-the-port/greener-transport/liquefied-natural-gas---the-marine-fuel-of-the-future/>

^{xlix} <https://www.portofgothenburg.com/about-the-port/greener-transport/onshore-power-supply-for-vessels/>

ⁱ <https://www.catxalot.se/en-GB>

^{li} <http://www.fishyourdream.com/en/>

^{lii} <http://extra.lansstyrelsen.se/kosterhavet/En/Pages/index.aspx>

^{liii} <https://www.innovatum.se/starta-och-utveckla/utvecklingsprojekt/var-process/>

^{liv} http://offshorevast.se/media/2016/10/TSS_folder16_Final.pdf

^{lv} <http://www.simrishamn.se/sv/marint-centrum/>

^{lvi} <http://hagainitativet.se/en/>

^{lvii} <http://www.sida.se/English/how-we-work/approaches-and-methods/funding/financing-for-development/swedish-leadership-for-sustainable-development/>

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Appendix 1

- Workshop agenda
- List of participants



Näringslivets insatser för hållbara hav – initiativ, hinder och möjligheter

Program

09.30 Registrering - kaffe finns tillgängligt

10.00 Välkommen

Moderator *John Munthe, Forskningschef IVL Svenska Miljöinstitutet*

10.05 Introduktion

De globala scenarierna för en hållbar havsmiljö – vad är status och vad krävs?
Sveriges pågående arbete med SDG 14. *Jakob Granit, Generaldirektör Havs och Vatten-
myndigheten*

Introduktion av Maritima Strategin. *Linda Lingsten, Havs och vattenmyndigheten*

10.35 Goda initiativ

Introduktion till presentationer och diskussion. *Mona Olsson Öberg, IVL Svenska Miljöinstitutet*
Fyra exempel från svensk industri och sjöfart – åtgärder och innovationer i befintlig verksamhet

1. Stålindustri, *Sophie Carler, Jernkontoret*
2. Skogsindustri, *Magnus Karlsson, IVL*
3. Sjöfart, *Carl Carlsson, Zero Vision Tool*
4. Kemindustri, *Marie-Louise Johansson, Borealis*

Diskussion

Finns ytterligare exempel? Vad kan Sverige bäst bidra med?

12.35 Lunch

13.30 Tre initiativ för en hållbar blå tillväxt

1. Marin Biogas, *Olle Stenberg*
2. Smögenlax, *Joel Oresten*
3. Swedish Algae factory, *Sofie Allert*

15.15 Diskussion

Finns ytterligare exempel? Vad kan Sverige bäst bidra med?

Paneldebatt: Vilka hinder finns? Vad kan främja och underlätta utvecklingen? Hur kan Sverige agera för att underlätta arbetet internationellt?

Inger Strömdahl, Svenskt Näringsliv, Sonja Blom, Perstorp, Sophie Carler, Jernkontoret, Anne Gunnäs, Lysekils kommun, Roine Morin, Skogsindustrierna och Olle Stenberg, Marin Biogas

15.45 Hur går vi vidare med förberedelserna inför FN-konferensen?

Jakob Granit, Generaldirektör Havs- och vattenmyndigheten och John Munthe, IVL Svenska Miljöinstitutet

16.00 Mingel

Näringslivets insatser för hållbara hav – initiativ, hinder och möjligheter

Göteborg, 2017-03-21

Sofie Allert, Swedish Algae Factory
Tomas Andersson, Havs- och Vattenmyndigheten
Pia Andersson, SMHI
Tom Arnbom, Världsnaturfonden WWF
Fredrik Arrhenius, Havs- och Vattenmyndigheten
Monica Bergsten, Vattenmyndigheten Västerhavet
Sonja Blom, Perstorp
Sophie Carler, Jernkontoret
Carl Carlsson, Zero Vision Tool
Johanna Christoffersson, Näringsdepartementet
Rosanna Endre, Greenpeace
Peder Falkman, ABIT
Erik Fridell, IVL Svenska Miljöinstitutet
Jakob Granit, Havs- och Vattenmyndigheten
Fredrik Gröndahl, KTH
Anne Gunnäs, Lysekils kommun
Katarina Gårdfeldt, Chalmers
Thord Görling, FF NORDEN
Rebecka H Jorquera, Göteborgs miljövetenskapliga centru
Jorid Hammersland, Miljö- och energidepartementet
Catarina Hedar, Havs- och vattenmyndigheten
Jessica Hjerpe Olausson, VGR
Susanne Härenstam, Göteborgsregionens kommunalförb
Marie-Louise Johansson, Borealis
Thomas Johansson, Havs- och Vattenmyndigheten
Anna Jöborn, Havs- och Vattenmyndigheten
Florina Lachmann, Havsmiljöinstitutet
Ida Lindbergh, Göteborgsregionens kommunalförbund
Susanne Lindegarth, Göteborgs universitet
Göran Lindqvist, Arctic Paper Munkedals AB
Arne Lindström, Orust e-boats
Linda Lingsten, Havs- och vattenmyndigheten
Roine Morin, Södra
John Munthe, IVL Svenska Miljöinstitutet
Anna Nordén, GMV, SDSN Northern Europe
Mona Olsson Öberg, IVL Svenska Miljöinstitutet

Joel Oresten, Smögenlax
Laura Piriz, HAV OCH OSPAR
Peter Ronelöv Olsson, Sveriges fiskares produsentorganis
Veronica Rosén, Entreprenörsarenan
Isabel Sarenmalm, Näringsdepartementet
Ulrika Siira, Havs- och vattenmyndigheten
Sara Sköld, IVL Svenska Miljöinstitutet
Olle Stenberg, Marin Biogas
Inger Strömdahl, Svenskt Näringsliv Service
Eva-lotta Sundblad, Havsmiljöinstitutet
Sixten Söderberg, FF Norden
Kajsa Tönnesson, Havsmiljöinstitutet
Åsa Wilske, Ramböll
Friederike Ziegler, RISE Agrifood and Bioscience



Appendix 2-14

Appendix	Organisation/Sector	Initiative
2	Steel industry	Long-term partnership for recipient monitoring
3	Agriculture	For more than 15 years, the joint venture Focus on Nutrients has delivered advice for agriculture and reduced environmental impact
4	Pulp and paper industry	50 years of environmental measures. By interaction between industry, authorities, and scientists, substantial improvement in receiving waters has been achieved
5	Fish industry	Collaboration to remove and recycle marine plastic debris
6	Shipping	A long-term cooperation for a safer, more environmentally, climate and energy efficient, transport at sea
7	Blue Growth	Circular land-based salmon production
8	Blue Growth	Farming of Sea squirts for biogas production and as a nutrient catch crop
9	Waste management	Partnership for reducing plastic waste
10	Chemical Industry	Plastic industry acts to prevent plastic littering and promote recycling.
11	Waste water treatment	Systems for purification of pharmaceuticals and other priority substances
12	Shipping	Electrification of ferry-line
13	Blue Growth	Using microalgae to improve water quality and reduce fossil dependence
14	Energy	Development of a converter for highly efficient wave energy generation

ORGANISATION

SSAB

CONTACT

info@ssab.com



PARTNERSHIP FOR RECIPIENT MONITORING

A Swedish initiative for achieving SDG 14 target 14.2

THE CHALLENGE

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

SSAB in Oxelösund, with a history of over 100 years, is a world leading producer of high strength steel, and is the regions' largest private employer with more than 2000 employees.

Emissions to receiving waters have historically included metals (such as cadmium, lead and zinc), PAH, eutrophication and oxygen depleting substances which imply a risk of negative impact in the recipient, a part of the Baltic Sea.

PARTNERSHIP IN RECIPIENT MONITORING PROVIDES INFORMATION REGARDING ENVIRONMENTAL IMPACT THAT FORM A BASIS FOR ASSESSMENT OF MEASURES AND ACTIONS.

The three main actors in the city of Oxelösund, SSAB, Oxelösund Hamn city harbour) and Oxelösund Energi (Energy company) power a coordinated monitoring program, for the coastal recipient area. The program has been developed

in co-operation with the county government, the regional water conservation association and Stockholm University, who also perform the yearly monitoring activities.

The coordinated monitoring includes yearly sampling of water and every second year sampling of sediments, fish and clams in a number of testing sites in addition to the SSAB site and along the coast line. The partnership is in place since 2007.

THE PARTNERSHIP PROVIDES EFFICIENCY AND KNOWLEDGE DISSEMINATION.

- Structured and recurrent monitoring provides possibility to discover changes in water quality. As sampling is done in a uniform way, yearly, quality assurance is high.
- Coordinated monitoring is cost efficient.
- Coordination provides information, dissemination and dialogue on a local, regional and national level. Yearly seminars are held at SSAB by Stockholm University where monitoring results are presented.
- Partnership provides possibilities for applied research.



ORGANISATION

Joint-venture between the Swedish Board of Agriculture, The Swedish Federation of Farmers and 17 regional County Administration Boards in southern and middle Sweden

CONTACT

www.greppa.nu



FOCUS ON NUTRIENTS

Initiative for achieving SDG 14 target 14.1

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

How the food we eat is produced is of major significance for our environment. This is why the role of agriculture in society and environmental achievements are important pieces of the puzzle when it comes to building a sustainable society.

Focus on Nutrients is the largest single undertaking in Sweden to reduce losses of nutrients to air and water from livestock and crop production.

FOR MORE THAN 15 YEARS, FOCUS ON NUTRIENTS HAS DELIVERED ADVICE FOR AGRICULTURE AND REDUCED ENVIRONMENTAL IMPACT.

Focus on Nutrients offers farmers knowledge and tools to implement cost-effective environmental and climate measures. The work is carried out with the help of advisers from a large proportion of agriculture's advisory companies. The county

administrative boards administer and lead activities in their counties, in cooperation with the Federation of Swedish Farmers (LRF), among others.

Focus on nutrients has implemented a totally new approach to advisory services including e.g. follow-up, systematic approach holistic view and reporting and about 50 000 visits to farms have been made.

Focus on Nutrients is an example of a Swedish model where mutual understanding takes pride of place. The fact that Focus on Nutrients has lasted for an more than a decade is largely due to the willingness to change that has characterised the process.

The Swedish environmental quality objectives were the background to the formation of Focus on Nutrients with objectives for reduced emissions of nitrogen and phosphorus. These remain important objectives but now there are new assignments related to water and climate, not least as a result of the EU water directive.

FOCUS ON NUTRIENTS HAS TURNED OUT TO BE A PIONEER WHEN IT COMES TO TESTING INDIVIDUAL, REPEATED FARM ADVISORY SERVICES ON A LARGE SCALE.

The combination of traditional information and agri-environmental payments has been successful in Sweden. Interest in advisory services as a tool in agriculture's environmental work has shown a clear increase during the years Focus on Nutrients has been in operation.

The Swedish environmental objectives have been a driver for the development of Focus on Nutrients. The EU framework directive on water has resulted in a new, major incentive to implement water management measures. This has led to an increased need for advisory services and to tailor made on-farm advice on most effective measures to reduce eutrophication, climate impact and to reduce risk of pesticide residues in waters.

ORGANISATION

Swedish pulp and paper industry

CONTACT

Magnus Karlsson, IVL, magnus.karlsson@ivl.se
Christina Wiklund, Skogsindustrierna,
christina.wiklund@forestindustries.se



REDUCING ENVIRONMENTAL IMPACT FROM THE PULP AND PAPER INDUSTRY A Swedish initiative for achieving SDG 14 target 14.1 and 14.2

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

The pulp and paper industry has been one of the corner stones in the Swedish economy the last century. The pulp and paper industry has also a unique position in the Swedish environmental history as being the sector that has undergone the largest change from an environmental perspective.

The mills are located both along the Swedish coasts and inland. The environmental impact has therefore been both extensive and wide-ranging in a geographical sense. However, since the

environmental problems were noted about 50 years ago a purposeful environmental work has been going on. Today the impact of the sector is extremely limited.

BY INTERACTION BETWEEN INDUSTRY, AUTHORITIES, AND SCIENTISTS, CONSIDERABLE IMPROVEMENTS IN RECEIVING WATERS HAVE BEEN ACHIEVED.

During the past 50 years, the pulp and the paper industry have been working in joint environmental research projects. The pulp and paper industry was also was the initiator of the formation of the research institute IVL together with the state.

The joint environmental research projects have been carried out in project form and submitted to institutions like IVL, universities and been performed in consultation with the Environmental Protection Agency. The projects have interrupted each other and the remaining questions have been raised in the next.

The aim has primarily been to provide ecological background material, to inventory and evaluate various environmental protection technologies and to support the introduction of new technologies.

Throughout the years, extensive environmental studies and monitoring have been carried out in the receiving waters of the plants. Beside this monitoring programs have been performed in co-operation with county government and other industry sectors with emissions to the same recipient.

Based on the knowledge the processes have been changed in order to Reduce formation and emissions of pollution. Recycling of process flows have increased and biological treatment plants introduced. Today, it has been showed that the environmental impact of the Swedish pulp and paper industry has been substantially reduced.

EXPERIENCES CAN BE USED FOR FUTURE ACHIEVEMENTS.

Actions based on knowledge, transparency, cooperation with different sectors of society and well-functioning legislation have been proven to lead to a successful environmental work.

The evaluation of historical development and the current environmental status can be used for general assessments of various types of environmental problems. It is clear that receiving waters can respond differently to environmental measures due to the character of the receiving areas.

The knowledge and experiences can also be used in other parts of the world where industry is expanding.



ORGANISATION

The Fish Auktion in Smögen, Fiskareföreningen Norden (A fishermen's association), Plastix A/S, Municipalities, Swedish Agency for Marine and Water Management

CONTACT

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FISH INDUSTRY PARTNERS COLLABORATE TO REMOVE AND RECYCLE MARINE PLASTIC DEBRIS A Swedish initiative for achieving SDG 14 target 14.1

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

Between 4000-8000 m³ of marine litter floats ashore every year on the Swedish west coast. Plastic debris constitutes the main part of the marine litter and consists of anything from microscopic particles to barrels, fishing gear and small discarded boats.

Due to the geographical location and the ocean current patterns, the coast of the county Bohuslän is most severely affected. A large part of the marine plastic debris does, however, sink and is then more difficult to collect and recycle. It is then left to degrade to microplastic, which is even more difficult to remove from the marine environment.

Beach clearing has now become very costly for the municipalities. Marine debris also causes damage to fishing gear and ships, amounting to annual

costs of 10 MSEK for the local west coast fishermen. The local fishermen use around 1-2 hours per week on clearing their gear from plastic debris.

SKAGERRAK IS CLEARED FROM PLASTIC DEBRIS WITH THE HELP OF LOCAL FISHERMEN AND COLLABORATIVE CHAINS FOR PLASTIC RECYCLING.

The Fish Auktion in Smögen has taken the lead in initiating an environmental project “keep the ocean clean” aiming to reduce marine plastic pollution for a clean and living Skagerrak. The newly started project provides professional fishermen with an easy access to dispose of and sort marine plastic when caught in trawls and other fishing gear.

The project also includes easy disposal of used fishing gear, trawls, nets and ropes, which in turn reduces marine plastic pollution. Companies work together with municipalities and the initiative is supported by the Swedish Agency for Marine and Water Management in its start-up phase.

Together the actors form a complete chain from plastic debris caught in the ocean to recycled industrial product. The chain includes individual fishermen; the Fish Auktion in Smögen where all west coast fish is landed, Fiskareföreningen Norden who separate the landed marine litter and the Danish company Plastix A/S, which convert plastic litter into plastic raw material for industrial use.

LOCAL FISHERMEN HELP CLEANING THE SEAS FROM PLASTIC DEBRIS.

- An efficient collaborative chain enables removal of plastic debris from the coastal seas and enables industrial plastic recycling.
- Partnership provides possibilities and visualizes working efforts.
- Trust is built between communities and companies for a clean sea.



ORGANISATION

The ZVT steering committee includes Swedish Shipowners' Association, Association Ports of Sweden, Swedish sustainable Shipping AB and representing the Finnish Maritime Cluster; Finnish Shipowners' Association and Finnish Port Association.

CONTACT

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ZERO VISION TOOL FOR A SAFER, MORE ENVIRONMENTALLY, CLIMATE AND ENERGY EFFICIENT WHILE STILL PROFITABLE, TRANSPORT AT SEA

Initiative for achieving SDG 14 target 14.1 and 14.3

THE CHALLENGE

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

Increased transport by sea can contribute to increased economic growth and welfare, while reducing negative environmental and climate impact, number of accidents and energy consumption. With that in mind the Zero Vision Tool method was developed in 2011. Today representatives from over 120 different organisations from the industry, academy, agencies and administrations meet to share experiences and find common workable sustainable solutions. When describing how ZVT finds the way forward, towards the vision, “the four arrows” in the picture above

need to work together, three pointing up; increasing economic growth, welfare and transport at sea, and one pointing down; reducing negative environmental impact, accidents and energy consumption.

SHARING EXPERIENCES AND FINDING COMMON SUSTAINABLE SOLUTIONS FORM THE PLATFORM FOR DEVELOPMENT TOWARDS THE VISION.

Zero Vision Tool is a pioneering platform and collaboration method for shipping stakeholders to develop and maintain activities that bring benefits to the sea, to the society, and also are economically prosperous. Zero Vision Tool offers tools and models that:

- Generate decision support and raise issues of common interest.
- Generate experiences for the maritime industry, authorities and government agencies, and make it possible to create common workable solutions.

- Make it possible to achieve the Zero Vision and realise the ambition to increase the cargo volume transported at sea at a quicker pace.
- Support the implementation and commercialisation of new technologies and innovations.

ZVT success was made possible due to engagement of its stakeholders and their eagerness to innovate and make a paradigm shift in how can industry work together with other stakeholders to cope with environmental and economic challenges of today. Therefore, its actual results are way much more than a new vessel, a retrofitted engine or a newly defined scrubber technology. The main achievements actually are the conditions that ZVT participants had to create themselves, in order for being able to deliver these concrete outcomes. This work happened over the course of project development, over the few years' time. ZVT is a pioneering platform, and it provides a pioneering way of knowledge dissemination.

Knowledge is made available as an overview of those small steps that were necessary to be taken in order

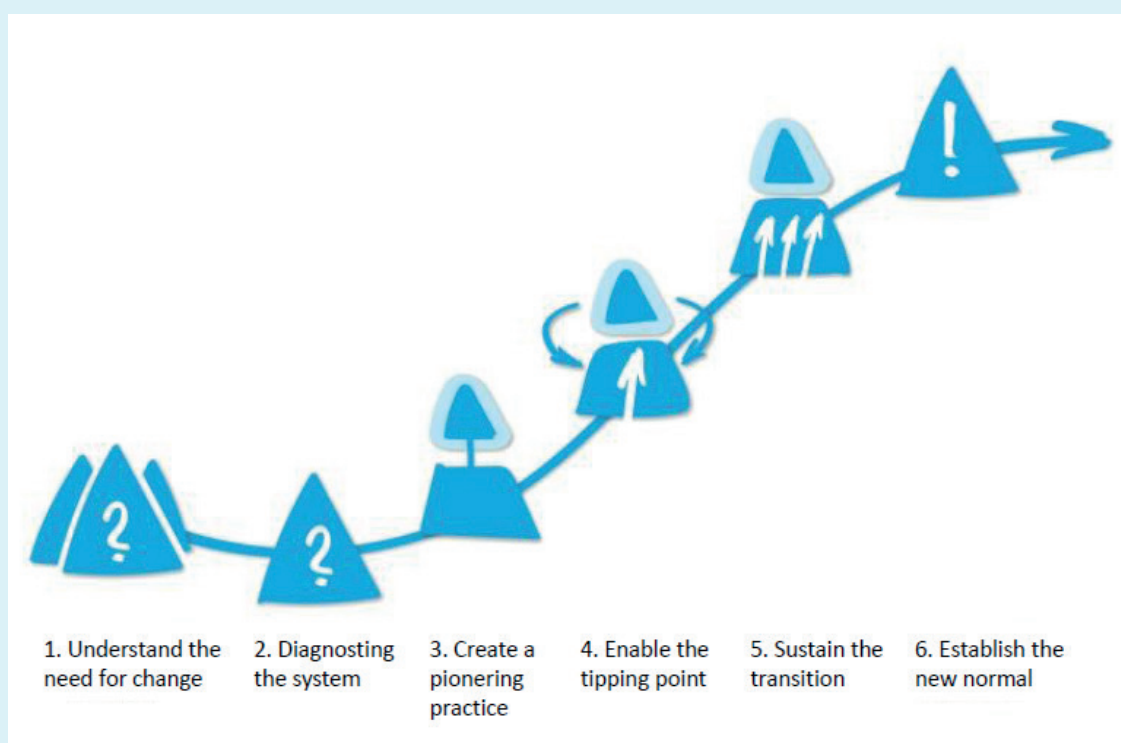
to make the big change happen. This is how we see exchange of experience and lessons learnt – one of the corner stones of ZVT method.

ZVT has developed a method for the change process, illustrated in the picture below.*

Presently, activities are at step four in the strive towards a new normal where green investments can be, and are, the natural choice. To create the tipping point different financial mechanisms such as risk sharing instruments and Pilot grants to mention a few are needed.

PROVIDING AN OPPORTUNITY TO EFFICIENTLY ACHIEVE LONG-TERM SUSTAINABLE SOLUTIONS

The ZVT platform provides an opportunity to use cooperation and structure to more efficiently achieve long-term sustainable solutions where the environment, safety issues and technology as well as human and financial factors are equally important. The method and process is likely to be of use in other parts of the world and in other industry branches.



*Method for the change process.

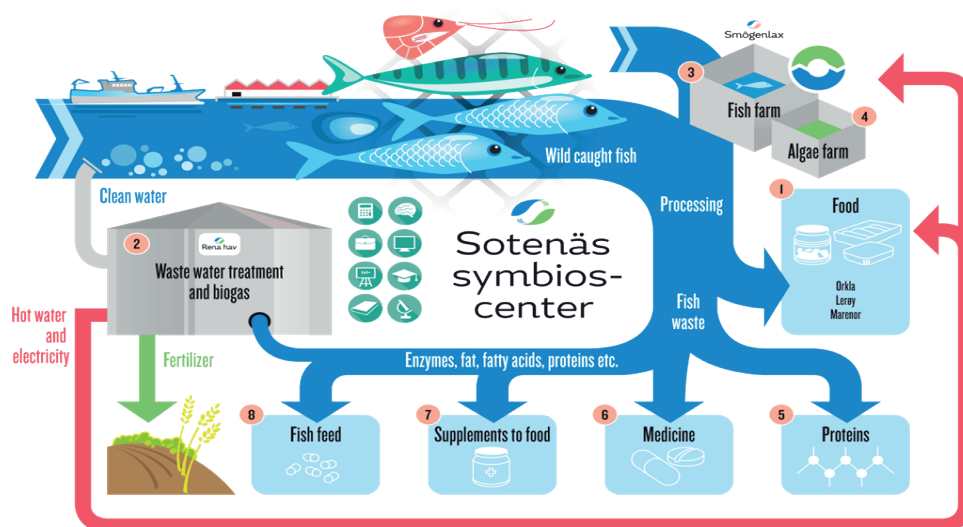


ORGANISATION

SmögenLax Aquaculture AB

CONTACT

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CIRCULAR LAND BASED AQUACULTURE

A Swedish initiative for achieving SDG 14 target 14.1

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

The farmed salmon industry has grown substantially in the past 40 years and today approximately 60% of the world's salmon production is farmed. Correspondingly, salmon consumption worldwide is three times greater today than it was in 1980. What was once a luxury food is now among the most popular and commonly served fish species in the U.S.A, Europe and Japan.

Due to favorable natural coastal conditions, Norway and Chile are the main producers of farmed salmon. However, many environmental problems are associated with ocean based fish farming and technically there are more suitable space available for salmon farming on land than in the world's coastal oceans.

CIRCULAR LAND BASED SALMON FARMING PROVIDES BETTER QUALITY FISH, CLEAN SEAS AND OPPORTUNITIES FOR MULTI-TROPHIC AQUACULTURE.

Land based recirculating aquaculture systems have the potential to greatly reduce the environmental impacts associated with ocean based fish farming. The most important problems include; uncontrolled and excessive emissions nutrients, pharmaceuticals and pesticides to the sea, escape of individual fish disrupting wild salmon populations and transmission of diseases (e.g. salmon lice).

The salmon farming by SmögenLax Aquaculture AB also involves using highly nutritious fish scraps from the local fishing industry in a novel type of fish feed. The fish scraps are unsuitable for human consumption and are currently discarded or used in biogas production, which disregards the true value.

In collaboration with other companies, marine algae are grown in the circulated fish tank water. The algae

purify the water from nutrients and are subsequently harvested and used in the fish feed as well as in other commercial products. This type of innovative multi-trophic farming ensures sustainable and efficient use of natural resources.

CIRCULAR LAND BASED SALMON FARMING PROVIDES CLEAN FOOD AND OCEANS.

- In these systems fish are not exposed to pathogens or parasites and therefore do not need to be treated with vaccines, pesticides or antibiotics.
- Because the water is recirculated this type of aquaculture does not contribute to coastal eutrophication or release of pesticides or pharmaceuticals.
- Land based farming does not affect natural fish populations.
- Possibilities of multi-trophic systems provide room for innovation and efficient use of natural resources.



ORGANISATION

Marin Biogas

CONTACT

www.marinebiogas.com



FARMED SEA SQUIRTS BECOME SUSTAINABLE FEED AND BIOENERGY WHILE SIMULTANEOUSLY CONTRIBUTING TO IMPROVE WATER QUALITY

A Swedish initiative for achieving SDG 14 target 14.1

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution. Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

Sea squirts are generally considered a nuisance or pest in mussel farms in Sweden, since they grow on all culturing equipment. The sea squirt *Ciona intestinalis* is a native and abundant species in Sweden and the company Marin Biogas has invented a system, which transforms this fast-growing problematic species into a valuable product.

Marin Biogas started the business by producing feedstock for biogas production and organic fertilizer after anaerobically digesting the harvested residue. Using the same production system, other novel products are also developed. One such product is

fish feed, high in marine proteins (65%) and lipids (7%), which in comparison with today's standard fishmeal products has a high environmental profile.

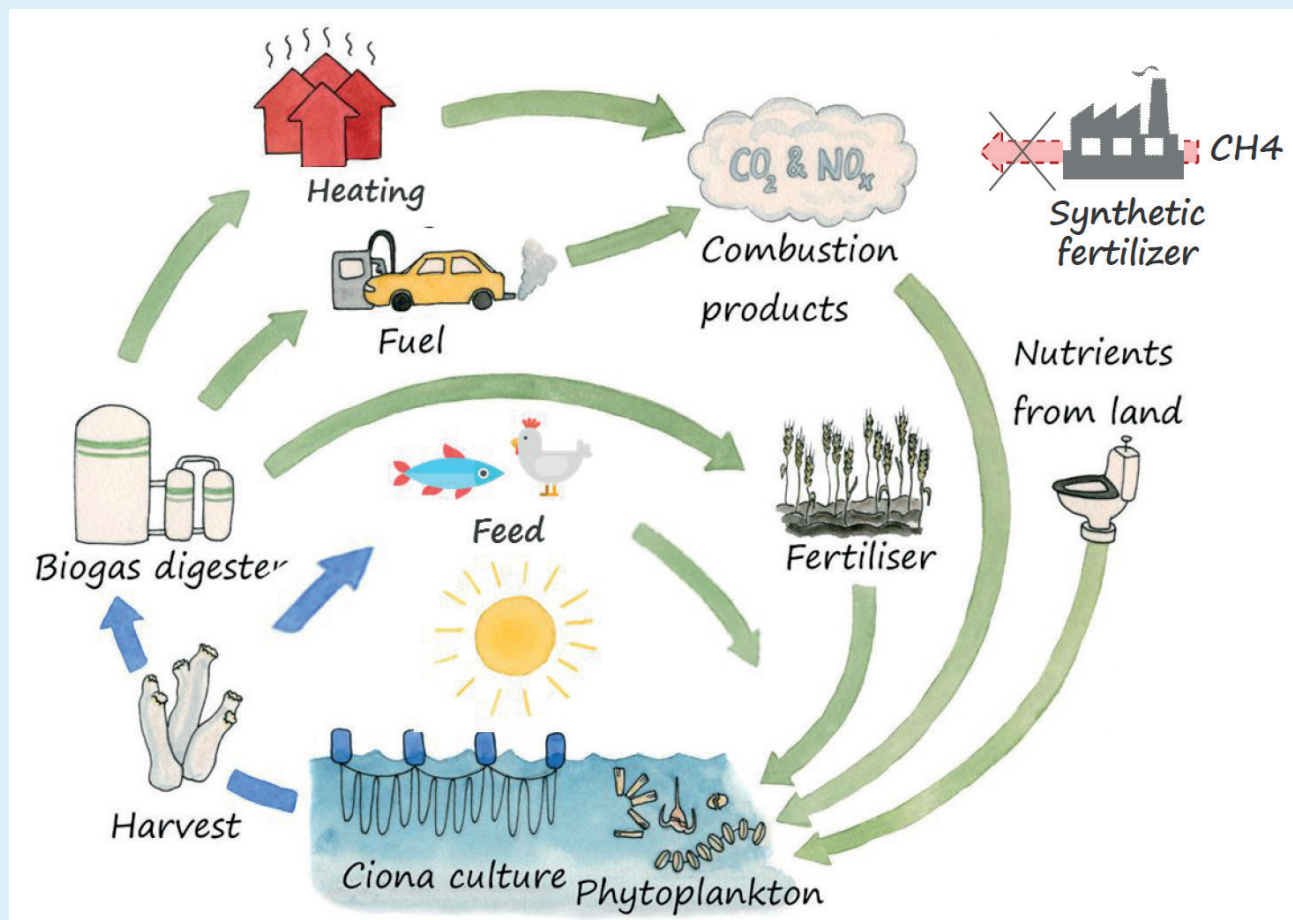
SEA SQUIRTS CONVERT ALGAL BLOOMS INTO BIOMASS FOR BIOGAS, ORGANIC FERTILIZER AND ENVIRONMENTALLY FRIENDLY FISH FEED.

Sea squirts feed on particulate organic matter such as microalgae, which are filtered continuously from the water column. Sea squirts grow very fast, which translates into a highly efficient biomass production in these natural systems. After harvesting the organisms, the biomass can be used for different purposes. The main products as of yet is biogas and fertilizer while other products, such as fish feed, are under development.

This circular system produces organic fertilizer while at the same time contributing to removing and

SEA SQUIRTS CIRCULATE MARINE AND HUMAN ENERGY AND NUTRIENTS.

- Sea squirt farming efficiently produce biomass suitable for conversion into ecofriendly biogas and organic fertilizer.





ORGANISATION

ISWA (The International Solid Waste Association)

CONTACT

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PARTNERSHIP FOR REDUCING MARINE LITTER

Swedish participation in an international task force

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

Malfunctioning waste management systems (lack of infrastructure, littering and waste dumping) contribute to the dispersion of plastic waste to receiving waters and further on to the oceans. (The International Solid Waste Association (ISWA) has initiated a Task Force on Marine Litter (TFML) with the aim to improve conditions and reduce the emissions of plastic waste to the oceans. An important component is to assist with knowledge and experience from the international arena. The Swedish Waste Management Association is highly involved in this initiative.

BY SHARING KNOWLEDGE AND EXPERIENCES REDUCTIONS OF MARINE LITTER CAN BE ACHIEVED.

Several targets for the task force have been identified

- Investigation of how sustainable waste treatment can reduce marine plastic litter.

- A Call for Action and/or Global Roadmap that can be adopted by individual countries with principles and general actions
- Creation of relations, links and platforms to enable the use of the global waste sector know-how and experiences for the purpose of the TFML

The main target groups are policy makers and government officials, NGOs and waste treatment organisations, including ISWA members.

EFFICIENT RECYCLING OF PLASTICS CAN REDUCE MARINE LITTER.

The global scope and the TFML includes both generation of the marine litter and the environmental impact of the marine waste. Focus is on plastic waste; the sources and pathways. The plastic waste can be produced both on land and at sea and can reach the oceans by a number of different pathways. Initiatives are to be built on earlier and present initiatives of ISWA and will contribute to an efficient recycling of plastics to prevent dispersion to receiving waters and oceans



ORGANISATION

Borealis AB

CONTACT

www.borealisgroup.com/sv/stenungsund/



PLASTIC INDUSTRY ACTS TO PREVENT PLASTIC LITTERING AND PROMOTE RECYCLING

A Swedish initiative for achieving SDG 14 target 14.1

THE CHALLENGE

By 2025, prevent and significantly reduce marine littering of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

Borealis AB located on the shore of Stenungsund on the Swedish west coast is part of Borealis Group, a leading provider of innovative solutions in the fields of polyolefins, base chemicals and fertilizers.

Borealis AB, was founded in the 1960ies and is the only polyethylene (PE) producer in Sweden. In Stenungsund, the company runs a highly flexible cracker that produces ethylene and propylene, which are then converted into high and low density polyethylene (HDPE/LDPE). With an annual capacity of 750.000 tons the polyethylene plant delivers products mainly for the wire & cable and pipe industry. The cracker plant feedstock and products are transported by ship and with more than 500 annual port calls this makes Stenungsund one of the largest industrial harbours in Sweden.

Ten years ago a study showed elevated levels of microscopic plastic particles in adjacent coastal waters nearby Stenungsund. In order to reduce the unintentional release of micro plastics, Borealis AB has constructed a state of the art system for collecting rain-, runoff- and process water. Borealis believes that plastics are too valuable to be thrown away and shall by no means end up in the environment. The company has therefore taken a leading role in plastic waste prevention taking action mainly in the following three areas.

ZERO PELLET LOSS

Plastic pellets released unintentionally during the production process can end up in streams, rivers and oceans. Preventing such unwanted spillage is a core responsibility for the industry and Borealis is therefore committed to achieving zero pellet loss in and around all its operations.

The company was an early signatory to Operation Clean Sweep®, a voluntary programme initiated by the Society of the Plastics Industry and the American Chemistry Council, and rolled out in Europe by PlasticsEurope. During the past years, Borealis has put continuous efforts and investments in achieving zero pellet loss by creating strict routines for vehicles, stories and snow removals as well as optimising drain gutters, installing pellet retention barriers and new manhole covers, and providing appropriate clean-up tools.

For removal of micro particles in water streams leaving the PE plant Borealis AB has installed duplicate filter system (10 µm) which the water is passing before entering the sea.

ADVANCING THE CIRCULARITY OF POLYOLEFINS

Design for circularity is a prerequisite to prevent plastic products are littered and ultimately ending up in the ocean. Borealis is fully committed to the principles of a circular economy, and has engaged to become a technology leader in plastics recycling.

To take an active role in addressing today's market, technological and system barriers in this area, in 2016 the company acquired German plastics recyclers mtm plastics and mtm compact, technology leaders and one of Europe's largest producers of post-consumer polyolefin recyclates. Furthermore, over the last years, Borealis has been advancing product innovation to improve resource efficiency and increase the recyclability of its products.

ACTIVE PARTICIPATION IN STAKEHOLDER DIALOGUE AND VALUE CHAIN INITIATIVES

In order to achieve transformation from a linear to a more circular economy of polyolefins, cooperation with all players along the value chain and beyond is essential. Borealis therefore participated in the creation of the Polyolefin Circular Economy Platform (PCEP), and recently joined the New Plastics Economy initiative led by the Ellen MacArthur Foundation.



ORGANISATION

KTH, SYVAB, Stockholm Vatten, IVL financed by SwAM and the participating organisations

CONTACT

www.ivl.se



SYSTEMS FOR THE PURIFICATION OF PHARMACEUTICAL RESIDUES AND OTHER PRIORITY PERSISTENT SUBSTANCES A Swedish initiative for achieving SDG 14 target 14.1

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

The removal of pharmaceutical residues and other emerging substances from the effluent of sewage treatment plants is critical for the protection of water quality and thus an important contribution to a sustainable society in balance with nature. The topic is gaining increasing interest and many organizations are involved in research, development and building up knowledge.

PROVIDING GENERAL AWARENESS AND KNOWLEDGE.

The project is intended to increase the general awareness and knowledge at all levels in relevant organisations such as legislation authorities and

sewage treatment plants and to support decision making and implementation of new technologies.

The aim is to provide a hands-on guide for STPs, authorities, and other organizations already engaged or intending to work with the removal of pharmaceutical residues and other emerging substances from the effluent of sewage treatment plants.

In knowledge development, it is important to recognize the complexity of the behaviour of emerging substances in sewage treatment plants and thus also in the assessment of efficiency and applicability of removal techniques.

Several aspects such as target definition, sampling, sample handling and analysis, result evaluation as well as total costs and environmental impact of a technology need to be assessed in a holistic approach

to provide practical advice on choice of technologies and to set realistic expectations.

To provide a complete review, various national and international experts and scientific reviewers from various organizations and related projects have been involved.

CONTRIBUTING TO DEVELOPED REMOVAL TECHNIQUES IN A SYSTEM AND SUSTAINABILITY PERSPECTIVE

The project contributes to the need of developed removal techniques for pharmaceutical residues and other emerging substances by:

- Identification of substances of high concern and guidance to improved analysis
- Contribution to the development and implementation of efficient removal techniques
- Providing basis and support for decision of separation technology from a sustainability and system perspective



ORGANISATION

HH Ferries group and ABB Marine and Ports

CONTACT

info@hhferriesgroup.com



SAILING WITH THE CURRENT- ELECTRIFICATION OF SHIPS

A Swedish initiative for achieving SDG 14 target 14.1 and 14.3

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution. Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

The HH Ferries group operates the Helsingborg-Helsingør ferry route, transporting up to 50 000 passengers and 9 000 cars across Öresund on a daily basis, with departures every fifteen minutes. In 2016, 7.3 million passengers and 1.4 million cars, 410 000 trucks and 20 000 buses, used the ferry connection corresponding to around 20 percent of the vehicles crossing Öresund. The route promotes integration and growth in the Öresund region, and is operated by 750 employees. It runs on a daily basis to ensure an efficient connection between Denmark and Sweden and contributes to generating up to 2000 jobs in the region.

Emissions from shipping pollute both the air and the sea. Air pollution is generated through combustion of fossil fuels and includes carbon dioxide, sulphur dioxide, nitrogen oxides, PAHs, metals and particles. The environmental impact posed by shipping is not evenly distributed across the oceans but concentrates to busy shipping lanes and ports, where Öresund constitutes one of the busiest shipping routes in Europe.

SHIFTING FROM DIESEL FUEL ENGINES TO BATTERIES AUTOMATICALLY CHARGED AT EACH PORT CREATES ONE OF THE MOST ENVIRONMENT FRIENDLY FERRY LINES IN THE WORLD- SAILING WITH THE CURRENT.

The two ferries, Tycho Brahe and Aurora, will be among the first in the world to run on pure battery power on such a high-frequency ferry route as Helsingborg-Helsingør.

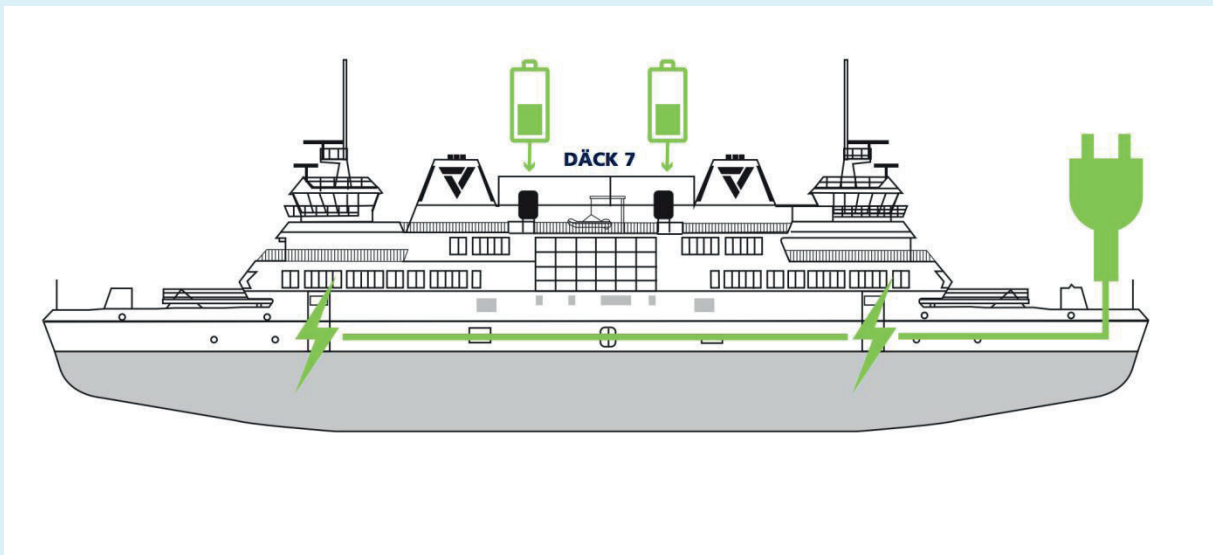
Instead of using diesel, the engines will be charged with electricity from the newly built charging stations at each port.

ABB Marine and Ports will deliver and install the batteries, the energy storage control system and the Onboard DC Grid technology. 640 batteries of 6.5 kWh are installed on top of each ferry along with two deckhouses for transformers, converters and cooling of the batteries.

When heated by the engines, cooling water will be used for heating up the ship. At both ends of the route ABB will supply the first automated shore-side charging stations using an ABB industrial robot, at each landing providing power corresponding to 70 Teslas.

ELECTRIFICATION OF THE FERRIES CUTS COMBUSTION RELATED POLLUTION BY 100 PERCENT.

- Collaboration between the HH Ferries group and ABB Marine and Ports creates the foundation to develop a world leading technology towards efficient and emission-free ferry line operations.
- Combustion related emissions of acidifying carbon dioxide, sulphur dioxide, nitrogen oxides, and polluting PAHs, metals and particles will be reduced to zero.
- Being an important part of the infrastructure, the efficient and clean technology of the ferry line allows for sustainable ecological and economic development within the Öresund region.



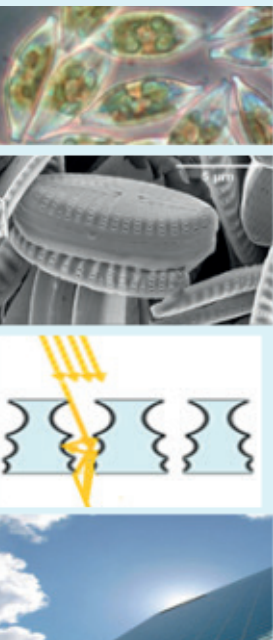


ORGANISATION

Swedish Algae Factory

CONTACT

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USING INHERENT FEATURES OF MICROALGAE TO IMPROVE WATER QUALITY AND REDUCE FOSSIL DEPENDENCE

A Swedish initiative for achieving SDG 14 target 14.1

THE CHALLENGE

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution. Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

Swedish Algae Factory is an idea-based innovation company. It was founded in 2014 around the unique traits of certain diatom species, i.e. their abilities to grow at low temperatures and under limited light conditions. In order to survive in the dark northern regions, the microalgae has a unique shell (frustule) designed through evolutionary time to trap, concentrate and manipulate light to maximize the energy input from the sun, which in turn drives photosynthesis and growth.

A motivation behind the company is the global need to reduce the use of fossilized energy reserves

and shift towards renewable energy sources such as solar power. Swedish Algae Factory aims to create a business that operates in harmony with nature, in real time, an industry that is based on a circular economic mindset where carbon dioxide and nitrogen and phosphorus emissions are converted into valuable products.

MICROALGAE GROWN IN WASTEWATER FROM CIRCULAR MULTI-TROPHIC AQUACULTURE SYSTEMS BECOME FISH FEED, ORGANIC FERTILIZER AND UNIQUE NANOMATERIALS ENHANCING SOLAR PANEL EFFICIENCY.

The possibility utilize the natural nutrient absorbing capabilities of live microalgae and later harvest them and use different parts as raw materials in commercial products is the aim of the enterprise. A novel algal cultivation facility has been constructed to be surface and energy efficient and facilitate less

energy intensive harvesting of the algae. The facility can be supplied with waste water from, e.g. land-based fish farms, and thus provide environment-friendly wastewater treatment in a multi-trophic aquaculture system. These types of constructions lead to reduced nutrient release in to coastal seas and prevent eutrophication.

After harvesting, the silica frustule of the algae is removed for use as, e.g. a unique solar cell efficiency enhancing nanomaterial. Tests show that the material enhances the efficiency of solar panels by over 4 percent, which provides enough excessive power from 10 m² of solar panels under Swedish climate conditions to power your computer for one year. This makes the bio-nanomaterials more efficient at enhancing the efficiency of solar panels than existing synthetic alternatives. The organic algae biomass contains bio-oils useful as feed ingredient

and organic matter which can be converted into eco-friendly fertilizers. Such fertilizers will partly contribute to the important recycling of phosphorous needed in our society to prevent starvation in the future.

MICROALGAE IMPROVE SOLAR ENERGY EFFICIENCY WHILE CLEANING WASTE WATER.

- Microalgae cultivation systems with novel design are used to reduce nutrients in circular land based multi-trophic aquaculture systems.
- Harvested diatom shells (frustules) make novel bio-based nanomaterials that enhance solar panel efficiency by at least 4 percent.
- The biomass from the remaining algae harvest becomes nutritious bio-oil components in fish feed and eco-friendly fertilizer high in phosphorous.



ORGANISATION

CorPower Ocean

CONTACT

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REVOLUTIONIZING WAVE POWER

A Swedish initiative for achieving SDG 14 target 14.1, 14.3 and 14.a

THE CHALLENGE

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

Minimize and address the impacts of ocean acidification including enhanced scientific cooperation at all levels. Increase scientific knowledge, develop research capacities and transfer marine technology..

CorPower Ocean brings a new class of high efficiency wave power technology to market, enabling robust and cost effective harvesting of electricity from ocean waves. The resonant Wave Energy Converters offer five times higher annual energy output per ton of device compared to previously known technology, giving a low cost per unit and simple effective offshore operations. The system has excellent survivability in storms, thanks to being inherently transparent to incoming wave energy.

FROM THE PRINCIPLES OF THE HUMAN HEART.

CorPower was founded in 2009 and has developed a compact high-efficiency Wave Energy Converter, inspired by the pumping principles of the human heart. . The step-change improvement in performance allows a Cost-of-Energy that can compete with offshore wind in the near term and established energy sources as the volumes increase.

The key challenge is to survive storms with good reliability and at the same time deliver enough annual energy in relation to the system life cycle cost making it a profitable business case. CorPower's devices are very compact and operate in resonance with incoming waves, delivering a large amount of power with small buoys. Survivability in storms is achieved by unique de-tuning mechanism, making the devices more transparent to incoming energy. Low CAPEX and an effective O&M scheme provide step-change reduction in Cost-of-Energy, enabling wave power to compete with offshore wind after 200MW of installed capacity.

AIMING TO ESTABLISH A NEW CLASS OF HIGHLY EFFECTIVE WAVE POWER FOR UTILITY-SCALE ENERGY GENERATION.

CorPower Ocean is currently in the stage 3 of its pilot program, which will entail taking a scale 1:2 25kW Wave Energy Converter (WEC) through the next step of structured verification by dry testing it in a rig in Stockholm, followed by wet testing during second part of 2017 at EMECs Scapa Flow nursery site in Orkney (Scotland). Stage 3 demonstration is supported by best practice from the European Marine Energy Centre (EMEC) in Orkney, alongside the experience from offshore power generation company Iberdrola Engineering, the University of Edinburgh, and WavEC Offshore Renewables' expertise in cost and performance modelling.

Testing activities in Stage 1 and 2 have proven that a significant improvement in the amount of annual energy per ton and annual energy per force can be offered compared to the current state of the art for Wave Energy Converters.

After verifying functionality, operations and economy of half scale system in 2017, CPO expects to launch its stage 4 with that testing of a full scale system before being able to launch the first units to the market.

Wave farms based on CPO technology require less capital investment, less ocean area, less materials and delivers a higher annual energy output for a given generation capacity. All enabled by system efficiency and smart control.



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