

# CLIMATE ROADMAP

Materials for Proposal to the Committee/Commission "Climate Roadmap 2050"



In April 2014, the government appointed in the Commission/Committee "Climate Roadmap 2050 (M 2014:03)"<sup>1</sup> as a part of EU's Energy Road Map 2050 COM (2011)885/2<sup>2</sup>. The Committee is supposed to present the results by 2 November 2015 at the latest. The Committee Directives mention transport, but not specifically maritime transport. It is of great importance that maritime transport is included and considered in "Climate Roadmap 2050" since maritime transport is part of the solution due to its substantial potential to develop sustainable transport both within and outside the country. The Swedish Shipowners' Association is contributing with this Climate Roadmap for Swedish shippings as a submission to the governmental "Climate Roadmap 2050" Committee.

Shipping is of outmost importance in the EU where nearly 90 percent of all external transportation is seaborne. Short-sea shipping accounts for 40 percent of the EU's internal transport measured in tonnes-km. In most contexts, shipping is the most energy-efficient mode of transport but, like all transport, has an environmental impact. Finding the best solutions to minimize the environmental impact requires efforts that have a long-term perspective and are well-focused. Swedish shipping has a given role in this context; as an industry, for our exports, for our strategic supply, and as a source of knowledge and a resource in the implementation of the national climate plan, "Climate Roadmap 2050".

The objective of the EU is to have reduced the emissions of greenhouse gases in 2050 by 80-95 percent compared with the levels in 1990. Sweden's long-term vision is to have zero net emissions of greenhouse gases to the atmosphere by 2050. In the spring of 2009, the Swedish Shipowners' Association adopted the "EU Maritime Transport Strategy 2009-2018". This strategy lays down "the long-term objective of zero-waste, zero-emission maritime transport". We call it the Zero Vision. The intention is that the Zero Vision will be achieved while the competitiveness of the Swedish maritime industry is increased.

The Swedish maritime and shipping industries are undertaking proactive and successful efforts to develop and implement measures to improve energy efficiency and reduce environmental impact, the use of alternative fuels and increased training. In order to be able to achieve the Zero Vision 2050, however, continued work is required as well as significant contributions from industry, together with expanded national and international support in the field of research, innovation and implementation. This work should be seen as a part of Sweden's, and consequently the EU's, efforts to promote blue growth in the Baltic region.

09-06-2015

*The Swedish Shipowners' Association*

---

<sup>1</sup> <http://www.regeringen.se/content/1/c6/23/79/93/55d3b7ac.pdf>

<sup>2</sup> [http://ec.europa.eu/energy/energy2020/roadmap/index\\_en.htm](http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm)

1	Research agenda .....	4
2	The Challenge .....	5
3	The Zero Vision requires a comprehensive systems approach ....	6
	THE MARITIME TRANSPORT SYSTEM .....	6
	DEVELOPMENT OF VESSEL SYSTEM.....	7
	STRUCTURE OF RESEARCH AND INNOVATION.....	8
4	Future scenarios for Swedish shipping, 2030 and 2050.....	9
	TARGET DEFINITION, 2030 .....	9
	TARGET DEFINITION, 2050 .....	10
5	The situation for the maritime transport system in 2015 .....	12
	PROFITABILITY AND FINANCING OF NEW ENVIRONMENTAL TECHNOLOGY.....	13
	THE MARITIME TRANSPORT INDUSTRY'S CURRENT DEVELOPMENT AND RESOURCES.....	15
6	Initiative of the Climate Roadmap .....	18
	COMMITTEE FOR RESEARCH AND INNOVATION.....	18
	RESEARCH – LIGHTHOUSE .....	18
	INDUSTRIAL AND PILOT PROJECTS – ZERO VISION TOOL .....	18
	BEST PRACTICE AND TRAINING – SWESHIP ENERGY .....	18
	COLLABORATION .....	18



## 1 Research agenda

The overall objective of The Swedish Shipowners' Association's efforts in research and innovation is to strengthen the competitiveness of the Swedish maritime industry and its ability to actively contribute to a sustainable society. The research agenda, which is critical in order to achieve the Zero Vision, focuses on three areas:

- Strengthening competitiveness
- Increased safety
- Reduced environmental and climate impact

The environmental and climate issues are strongly connected to the other parts of the research agenda. A strong and profitable maritime industry is crucial for the ability to make the necessary investments and take the risks that implementation and development of new technologies, new logistics and new business models can involve. In the Swedish maritime industry, the work on safety issues is world class. Even from an environmental perspective, the safety issue is important. The negative environmental impact that would occur

in the event of a collision, with oil spills as a result, is an example of how maritime safety and environmental issues are closely related.

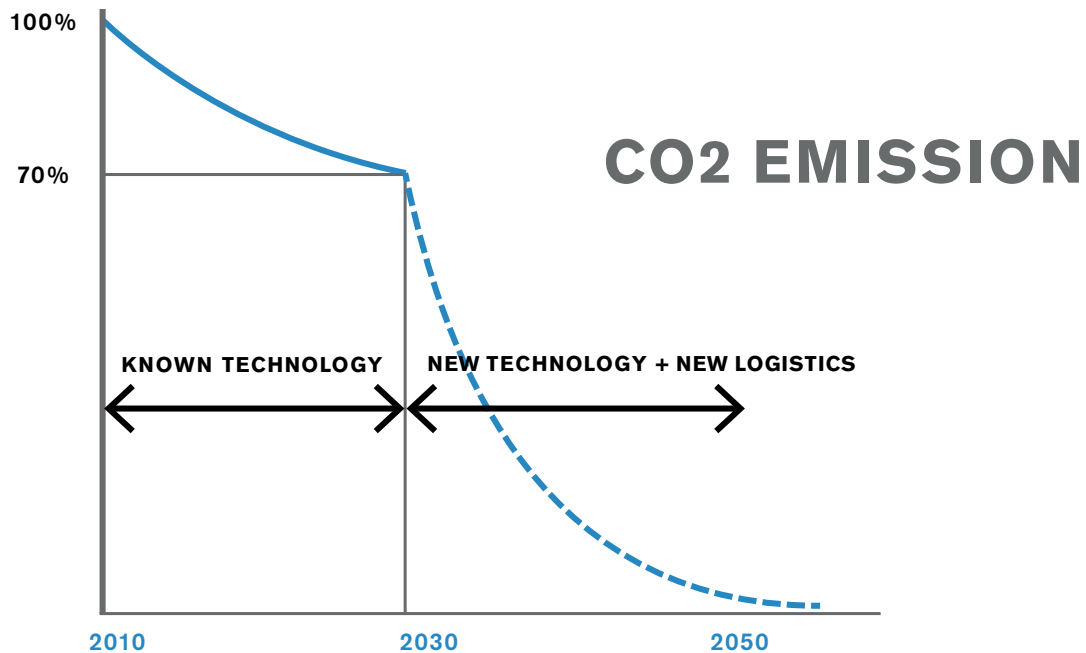
One of the goals of the Swedish maritime research agenda is that Swedish shipping should contribute to Sweden having no net emissions of greenhouse gases by 2050. This climate roadmap for the Swedish Shipowners' Association focuses on the reduction of the environmental and climate impact.

## 2 The Challenge

The overall objective is to strengthen the competitiveness of the Swedish shipping industry and its ability to actively contribute to a sustainable society. The targets can be divided into a number of short and long-term milestones.

- In a cost-effective manner satisfy new regional and international requirements regarding environment and safety
- Meeting stricter environmental and safety requirements offers competitive transport solutions to Swedish industry and thus increases the seaborne part of transportation, both within the country and for exports/imports
- Reduce CO2 emissions per transport by 30 percent in 2030 compared to 2010
- Completely eliminate emissions of CO2 and other harmful substances by 2050 - The Zero Vision
- Increase safety and be able to completely eliminate serious marine casualties and injuries – The Zero Vision
- Renew and strengthen the innovation capabilities of the Swedish shipping industry
- Actively contribute to a sustainable society

*CO2 emissions, possible scenario for the maritime industry based on the Climate Roadmap for the Swedish Maritime Industry*



### 3 The Zero Vision requires a comprehensive systems approach

In order for shipping to be able to achieve the goals of the Zero Vision, vessels need to be seen as parts of a larger maritime transport system, which in turn is part of a logistics system. New technical research results and innovations alone cannot achieve the goals of the Zero Vision. In order to achieve the Zero Vision, a comprehensive approach and broad interaction are required.

#### THE MARITIME TRANSPORT SYSTEM

The logistics system should contribute to both benefits to the customer and the community with a minimum of adverse environmental impact and a high level of safety. The system is affected by external factors and utilises available technology. The maritime transport system is the part of the logistics system

within which the vessels operate and it also includes, for example, ports, shipping companies, shipbrokers, etc. The maritime transport system has a major impact on customer benefits by means of, for example, price, degree of intermodality, frequency and the size of the vessels.

The vessel system consists of the physical ship itself and its crew, including decision support systems and other systems that monitor and control, both on board and ashore. The vessel system operates in a lifecycle where a plurality of processes are involved such as system development, ordering, operation and maintenance.

Compared with other types of transport, vessels are more complex and can be likened to a small community with a crew living on board. Usually, vessels

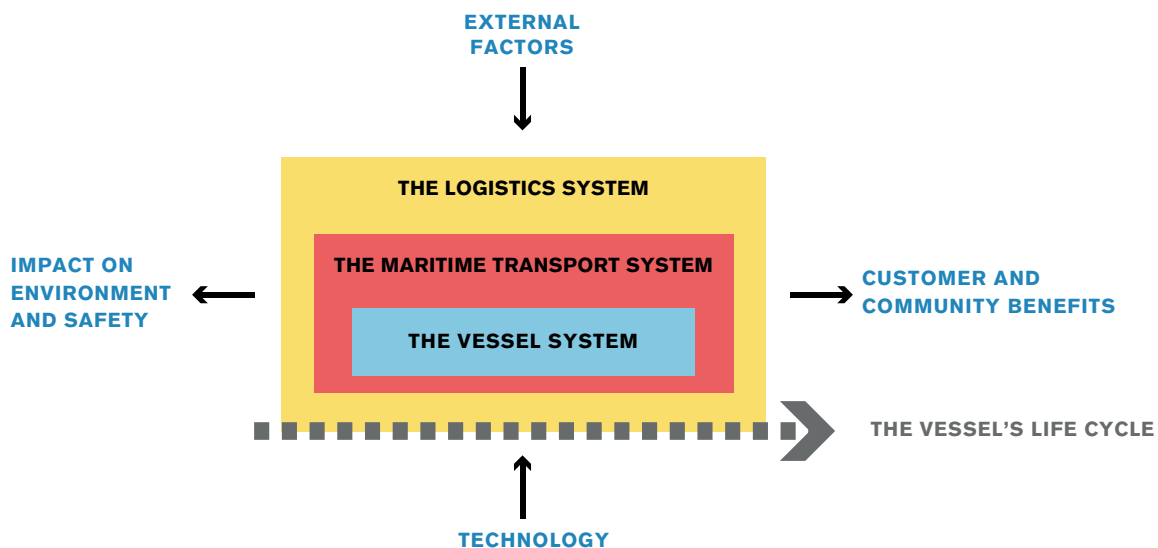
also have a longer life.

Customer and community benefits consist of, for example, the transport price, frequency, reliability, environmental impact and contributions to the growth of society.

External factors are, for example, the price and availability of fuels, regulations, infrastructure costs and policy instruments.

The impact on the environment covers all emissions and other impact generated by transportation that affect environment and people. The effect on safety includes the risk of accidents and injuries caused by transportation.

Technology includes, for example, available technologies with a degree of maturity, calculation methods and the ship's environmental impact.





## DEVELOPMENT OF VESSEL SYSTEMS

There are significant differences regarding development of vehicles, aircraft and vessels. Vehicles and aircraft are mainly developed and produced by major global suppliers in long series. Significant development costs are invested in each new vehicle model, an investment that is distributed across the large number of sold products of that same model. The individual transport companies do not need to use their own resources for the development of the vehicle or aircraft systems. Instead, investments in new resources are based on which basic models that are offered on the market. Suppliers also often take a life-cycle responsibility for the function of the vehicle.

Vessels are built in small series by a globally fragmented shipbuilding industry, which is primarily production oriented. Each vessel built at a shipyard is based on an order and product development per vessel is normally relatively small. The com-

petitiveness of the shipyards is based on capacity and delivery capability (price and delivery time) and not on the ability to develop a product. The shipyard has no life-cycle responsibility for the vessel's operation. This has resulted in most vessels being built in standard sizes based on traditional technology, production efficiency and regulations and conventions.

Swedish shipowners must therefore themselves or via networks develop the skills and ability to drive forwards technology development in a client role vis-a-vis a sometimes reluctant shipbuilding industry. The competence and ability of the shipping industry is thus crucial for rapid technology development. Moreover, state support for research and development in the field of maritime transport is very small in relation to other modes of transport and not always directed towards strengthening the competitiveness of shipping.

## STRUCTURE OF RESEARCH AND INNOVATION

It is the combination of several measures in a number of areas that may lead to maritime transport being able to achieve the Zero Vision.

Examples of such measures are new technology solutions, new logistic solutions, better integration with ports, new business models, organizational development, etc. Most research areas are traditionally applied but basic research is needed in specific areas:

- Institutional factors – how to highlight, analyze and influence limitations and create opportunities offered by the organizational structures, market structures, policy regulations and instruments?
- Processes – what analyses, decisions and management processes affect the life cycle of the vessel system, how can they be developed and improved?
- Technology – what technical solutions and methods can we develop?

The area “Institutional factors” aims to highlight the limitations but also the opportunities that are embedded in cultures, values and standards at various organizational levels of the shipping company, in the industry, in society, etc. Why are vessels still ordered based on old technological solutions that result in energy consumption that is 20 to 30 percent higher than it could have been if available knowledge had been used?

Investments in new environmental technologies are difficult for the shipping company to finance since no compensation or support is given despite the significant environmental gains for society. Maritime transportation often suffers from fee structures that are not transport neutral. How can the industry argue for a more equitable fee structure based on the different transport modes’ socioeconomic costs? This is crucial when it comes to increasing short-distance transportation by sea

and thus realizing significant environmental benefits.

The area Processes includes the various analytical, decision-making and management processes that will affect competitiveness as well as safety and environmental efficiency during the vessel’s lifetime. An innovative technological solution will be ineffective if not applied wisely in the realization of a new maritime transport system. For example, lower speed, increased cargo intake and less time in port greatly affect the vessel’s environmental efficiency.

The area Technology includes the traditional technology areas that are used or applied in the vessel system. Continued development in these areas is necessary but not sufficient to achieve the goals of the Zero Vision.



## 4 Future scenarios for Swedish shipping, 2030 and 2050

The target definitions for Swedish shipping are designed as future scenarios to achieve the Zero Vision.

### TARGET DEFINITION, 2030

Overall, the competitiveness of the Swedish shipping industry has been strengthened and the Swedish shipping cluster consolidated. Technology development and research are at the cutting edge in an international perspective.

Industrial conditions for Swedish shipping have significantly improved and competitive neutrality prevails in comparison with other modes of transport and maritime transport nations. New goals for society and the climate are based on scientific grounds and impact assessments.

Transport customers regard inland waterway transportation and short-sea shipping as competitive alternatives to

rail and road. Transport customers, ports, port states and other stakeholders reward an environmentally efficient maritime transport system based on relevant reported measurements.

Swedish public funding of research, innovation and demonstration projects in the field of maritime transport has risen to an annual volume of at least SEK 300 million. The shipping industry and the shipping companies are also contributing an equivalent amount. Major European projects are being established and Swedish funding is increasing so that the total framework for funding research, innovation and demonstration projects in the maritime transport system now amounts to about SEK 1,200 million per year.

Public venture capital and financial mechanisms in Sweden and the EU are in place to facilitate the transition to

more environmentally efficient technology.

Swedish shipping has developed transport systems resulting in reduced emissions of at least 30 percent. Ways to achieve this reduction are mainly:

- Investing in better vessel technology
- Investing in systems for alternative fuels or purification techniques
- Investing in vessels for inland navigation
- Increased collaboration between different stakeholders in the transport system
- Investing in energy management systems with associated systems for measurement and decision support
- Training in and collaboration on methods for energy efficient vessel operation

## TARGET DEFINITION, 2050

The Swedish shipping cluster is a world leader in technology development and research. The business conditions for Swedish shipping have resulted in a high degree of competitiveness with other modes of transport and maritime transport nations.

New goals for society and the climate are based on scientific grounds with a long-term perspective and international harmonization. Transport customers regard inland waterway transportation and short-sea shipping as a competitive alternative to rail and road.

Transport customers, ports, port states and other stakeholders reward environmentally efficient maritime transport system based on relevant reported measurements, and full transparency has become a natural customer requirement.

Swedish public funding of research, innovation and demonstration projects in the field of maritime transport has risen to an annual volume of at least SEK 500 million. The maritime transport industry and the shipping industry are also contributing an equivalent amount. Major European projects are being established and Swedish funding is increasing so that the total framework for funding research, innovation and demonstration projects in the maritime transport system now amounts to a total of SEK 2,000 million per year.

Public venture capital and financial mechanisms in Sweden and the EU are in place to facilitate the transition to more environmentally efficient technology. Proven environmental technologies are being implemented on a wide scale.

Swedish shipping has developed transport systems resulting in reduced emis-

sions almost in line with the Zero Vision. Ways to reach this reduction are mainly:

- Changing and restructuring the framework of the transport system
- Transport customers are balancing time of delivery with energy costs
- Fossil-free fuels / energy carriers are available
- Investing in better vessel technology
- Investing in systems for alternative fuels
- Investing in inland waterway vessels
- Increased collaboration between the different stakeholders in the transport system
- Investing in energy management systems with associated measurement and decision support systems
- Training in and collaboration on methods for energy-efficient vessel operation



## 5 The situation of shipping 2015

Today, Swedish shipping is a competitive industry but with unfavorable framework conditions; globally in competition with other shipping nations of the world and nationally with other modes of transport.

Shipping is very energy efficient compared to other modes of transport, but emissions as a whole are high since large volumes of goods are transported by the maritime transport system. Society has clear targets for reducing the amount of emissions to the atmosphere and water. New regulations are continuously being implemented.

In the case of maritime transport – like other modes of transport – the term cost and compliance is applied, i.e. performing the transportation in question as cost efficiently as possible within the framework of current regulations. The external costs for different modes of transport, e.g. public costs for infrastructure and accidents, are currently not considered in the fee system or instrument.

Environmental requirements in the form of mandatory regulations are mostly drawn up internationally by the UN body IMO.

Regional regulations introduced internationally impair the competitiveness of both short-sea shipping and basic industries. But there are also national regulations, such as in the United States with certain unilateral regulations for vessels entering US territorial waters. National rules may apply in the case of purely national waters, lakes and rivers.

In the case of international shipping in national waters, instruments in the form of savings or investment aid may be feasible. In Sweden, an agreement was signed early on between The Swedish Shipowners' Association, The Association of Swedish Ports and The Swedish Maritime Administration on environmentally differentiated dues for fairways and ports. The Norwegian NOx fund is another example of a method that differs from specific regional regulations.

## PROFITABILITY AND FINANCING OF NEW ENVIRONMENTAL TECHNOLOGY

Investments in shipping benefit the shore-based transport system, which today is highly congested. Current investments generate major environmental and health benefits, and often go beyond what is required by the regulations. The shipping industry takes great responsibility and is taking risks in the work on achieving the Zero Vision. Today, the major obstacles to achieving the Zero Vision are not primarily technical but rather financial instruments and economic incentives.

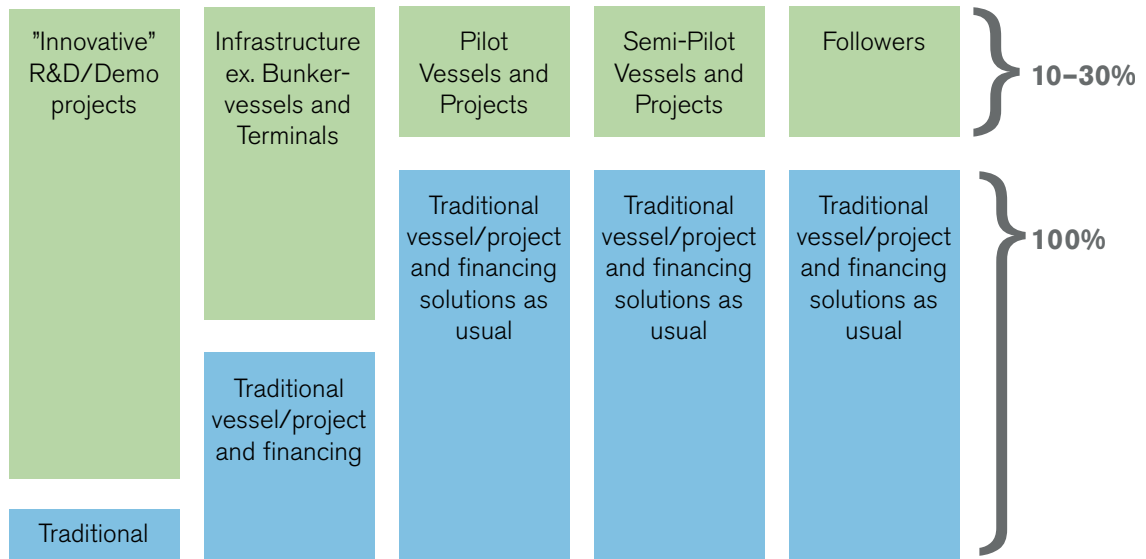
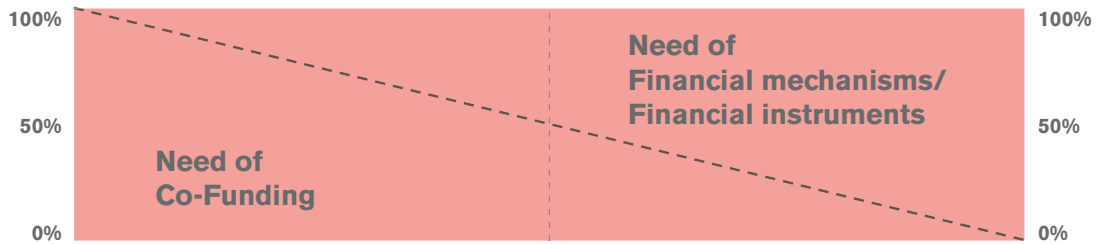
The development and implementation of new environmental technologies is costly, especially in the initial phase. In addition to the actual development, there is a need to test and verify the new technology in practical operations. New technical solutions often require the development of regulatory frameworks and the uncertainty regarding future regulations increases the risks. New technical solutions can rarely benefit from economies of scale in manufacturing until the technology is more generally applied. Transport customers are usually not prepared to pay more for more eco-efficient transportation, they only require that current regulations be met. The above-men-

tioned factors mean that it is difficult for shipping companies to finance new environmental technology on their own while maintaining profitability.

However, studies have shown that it often is very profitable for society to invest in environmental technologies thanks to their impact on health and the environment. In addition, it increases employment in the companies that develop and market new environmental technologies. When the socio-economic benefits are included, pay-off times of a few years are not uncommon. It is therefore important that society in various ways supports the introduction of new environmental technologies.

The need for support is greatest among initiators and pioneers. As implementation is established the need for direct support decreases. However, at that point more preferential loans and financial security provided by society are needed in order to enable a more widespread implementation of new environmental technology.

# Co-funding and Lending



*Need for co-financing and loans / financial security for new technology, logistics and new processes.*

## THE SHIPPING INDUSTRY'S CURRENT DEVELOPMENT AND RESOURCES

Shipping has historically been a conservative industry where developments in the mature segments are relatively modest and the introduction of new technologies takes a long time. The most important efficiency and rationalization methods are normally to increase the size of the vessels. Meanwhile, the industry has historically demonstrated a great flexibility when trading and transport patterns have changed. Swedish shipping companies have historically proved to be very innovative, one example is vehicle carriers (Wallenius) another is ro-ro vessels with effective ramps (Transatlantic).

In the last decade, large changes have occurred. A series of regulations have been implemented and several more appear to be imminent. Freight customers are showing an interest in more environmentally efficient transport and bunker oil prices have increased. Through shared knowledge and collaboration, major developments are taken place in Swedish shipping, which is at the cutting edge in many areas.

Swedish universities offer high-level education and research in the shipping and shipbuilding fields, which were established during the time when Sweden was a world-leading nation in shipping

and shipbuilding. This education and research has succeeded in maintaining a very high international standard, partly thanks to large investments in basic research and good relationships with the Swedish shipping industry.

In the last decade, important initiatives have been taken to stimulate multidisciplinary development in shipping and to intensify the exchange between industry and academia, such as Lighthouse (see below).

Research and development in the marine field is also being conducted at a number of research institutes such as SSPA, SP Technical Research Institute of Sweden, IVL Swedish Environmental Research Institute and Victoria Swedish ICT. These research institutes have a strong presence internationally in areas such as fluid mechanics, fire protection, ecosystem analysis and information technology for vehicles.

In addition to the shipping-oriented research conducted at universities, the shipping industry has taken numerous initiatives to promote long-term shipping research.

### LIGHTHOUSE

The Swedish Shipowners' Association and SSPA have together created the

Zero Vision Tool (ZVT), a collaborative approach and project platform in order to achieve the Zero Vision. The method is based on cooperation and shared knowledge where each industrial project consists of several different stakeholders who jointly identify possible shared solutions to a need. About 20 Joint Industry Projects (JIP) are being conducted within framework of the ZVT (2015). Ongoing are also a Joint Authority Project (JAP) and two Joint University Projects (JUP), one of which is calculating and verifying the benefits to society in all industrial projects. The Zero Vision Tool involves over 120 organizations from seven countries. The industrial projects are coordinated within three major pilot projects: Pilot LNG, Pilot Scrubber and Pilot Methanol, all of which have received co-financing from the European Commission TEN-T. Within the framework of ZVT, the Swedish shipping industry is investing over EUR 1,000 million in various solutions to deal with the challenge of special regulations and to achieve a profitable and cost-efficient Zero Vision.

([www.zerovisiontool.com](http://www.zerovisiontool.com))

### COMPETENCE CENTRE FOR ENERGY EFFICIENCY, SWESHIP ENERGY

In 2015, The Swedish Shipowners' Asso-

ciation established a competence centre in order to improve energy efficiency in the maritime transport system. At Sweship Energy, a database has been built up with real operating data from vessels. Shipping companies will implement projects for demonstration and development. Workshops with shipboard personnel will be held to share, develop and disseminate new knowledge and experience. The database will be made available for research and training in an anonymous form.

([www.sweshipenergy.se](http://www.sweshipenergy.se))

#### EFFSHIP

In the project "Efficient shipping with Low Emissions" (Effship), ways to create energy-efficient, long-term sustainable maritime transportation with a minimum of environmental impact while maintaining the long-term environmental objectives of society were investigated. The project, which ended in 2013 with a final report, laid the foundation for a number of follow-up studies and demonstration projects, including converting one of the world's largest RoPax ferries to methanol operation.

([www.effship.com](http://www.effship.com))

#### PROMSUS, PRODUCTION OF METHANOL SUSTAINABLY AND RELATED ENGINE TECHNOLOGIES

In May 2014 a group in the shipping indus-

try (ScandiNaos, Stena, Chalmers / Lighthouse, Wärtsilä, European Enterprise Network) gathered universities, development companies and industries of nine nationalities to discuss Production of Methanol and Related Sustainably Engine Technologies (PROMSUS) and propose action plans for further work.

*I maj 2014 samlade en grupp från sjöfartsnäringsen (ScandiNaos, Stena, Chalmers/Lighthouse, Wärtsilä, European Enterprise Network) universitet, utvecklingsföretag, industrier och nio nationaliteter, för att avhandla Production of Methanol Sustainably and Related Engine Technologies, (PROMSUS) och komma med förslag till handlingssplaner för vidare arbete.*

([www.marinemethanol.com](http://www.marinemethanol.com))





## 6 Climate Roadmap's Initiative

In order to handle the challenge of achieving the Zero Vision, far-reaching initiatives and operations, which no single player can master, are required. The overall strategy for the Climate Roadmap is therefore to seek cooperation and strive for shared knowledge. A number of initiatives have been started up at The Swedish Shipowners' Association. These include:

### **RESEARCH AND INNOVATION COMMITTEE**

The mission of The Swedish Shipowners' Association's Research and Innovation Committee is to continuously monitor the needs of research and innovation in the shipping industry with the goal of achieving the Zero Vision as well as increased growth and competitiveness. The priorities of research and innovation in the maritime transport system will be presented in the Research Strategy 2015-2017.

### **RESEARCH – LIGHTHOUSE**

At the competence centre Lighthouse, strategic program areas with scientific relevance are formulated for the Swedish shipping industry. Partnerships are sought with other strategic research areas such as the Internet of Things, Big Data and the automotive industry. The aim is to acquire financing from and to initiate cooperation with Horizon 2020 and other EU programs.

### **INDUSTRIAL AND PILOT PROJECTS – ZERO VISION TOOL**

Cooperation involving industrial, pilot and demonstration projects using the Zero Vision Tool platform is continuing with relevant stakeholders. Work includes finding and creating opportunities for external financing and risk coverage of new environmental technologies.

### **BEST PRACTICE AND**

### **TRAINING – SWESHIP ENERGY**

Develop a centre of excellence for energy efficiency, Sweship Energy, which supports cooperation and exchange of experience and ideas related to energy-efficient operation of vessels. In cooperation, develop and run training programs for both onboard and shore-based employees.

### **COOPERATION**

Seek cooperation and collaboration with other stakeholders in both society, academia and industry, nationally and internationally. Crucial collaboration partners include The Swedish Maritime Administration, the Swedish Energy Agency and Vinnova.

**Research**

**Demonstration /  
industrial projects**

**Improved  
energy efficiency**



*Initiative by The Swedish Shipowners' Association with the aim of contributing to achieving the Zero Vision*

Society strives for increased prosperity generated by growth in the economy. In order to increase growth and welfare, there is a greatly increased demand for maritime transport, both for cargo and passengers. The challenge is to increase growth and strengthen competitiveness at the same time as reducing the harmful emissions to the atmosphere and water and improving maritime safety.

As the first branch organization in Europe, The Swedish Shipowners' Association adopted the EU's Maritime Transport Strategy 2009-2018 in the spring of 2009. This strategy lays down "the long-term objective of zero-waste, zero-emission maritime transport".



## The Zero Vision