Institutional capacity building within scrubbers

- Assessment report on the knowledge obtained by participants during a seminar and study visit on a vessel with a scrubber installation

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Content

Introduction

This report assesses the long term capacity building effects from the study trip – *Scrubbers 360° - an overview of scrubber technology and a study visit to DFDS Primula Seaways* which was arranged by the EnviSuM project on the 9th of May 2017 in Gothenburg, Sweden.

From the 1st of January 2015 ships entering the Baltic and North Seas are required to use fuels that have maximum sulphur content of 0.1% or by using an approved "equivalent method" such as for example Exhaust Gas Cleaning Systems which is also called a "scrubber". Scrubbers are air pollution control systems that remove pollution from the exhaust gas and are a technology that can be used to remove SOx from the plume of smoke from ships. Most scrubbers onboard ships use water to "wash" the pollutants by spraying seawater into the scrubber whereby SOx reacts with the water and forms sulphuric acid. The scrubbers running on water are called wet scrubbers. Some wet scrubbers are "open loop" scrubbers where the wastewater is discharged back into the sea while others are "closed loop" scrubbers where water is recirculated in a closed system.

The project EnviSuM - *Environmental Impact of Low Emission Shipping: Measurements and Modeling Strategie*s - is funded by the European Regional Development Fund and focuses on studying technical efficiency and socio-economic impacts of clean shipping solutions. The project among other provides the shipping sector with guidance on how to support future investment decisions and furthermore investigates the performance of different available measures such as fuels and abatement techniques to meet the emission reduction targets. The EnviSuM project provides tested and analyzed results on the efficiency of the different clean shipping solutions allowing the project consortium to make recommendations benefiting the environment and the health of the people of the Baltic Sea Region while still supporting the maritime businesses and promoting economic growth.

There is a lot of scattered and contradicting information regarding the use of scrubbers in the shipping industry and the EnviSuM project therefore decided to arrange a study trip that gave participants both an overview of the technology as well as in depth understanding of the technical details. The focus was to combine theoretical knowledge with practical experience in order to give a holistic overview and in addition to foster collaboration and knowledge sharing amongst the various user groups in the maritime world and thereby help stakeholders make more qualified clean shipping decisions. This report assess to what extend the study trip has created capacity among participants as well, as if they have used it, the knowledge they obtained during the 12 months that followed the study trip.

Study trip agenda

The study trip took place on the 9th of May 2017 in Gothenburg, and started with presentations at Miljöforvaltningen.

The agenda of the study trip *Scrubbers 360°; an overview of scrubber technology and a study visit to DFDS Petunia Seaways* was as follows:

08:30 Coffee and registration

09:00 Welcome and introduction by the organizers, Jan Boyesen, Head of Development, MDC

09:15 Treatment of wastewater from open loop scrubbers by Johanna Snickars-Nykamb, Business Development Manager, Wärtsilä

09:45 The history of hybrid scrubbers and future possibilities for removing NOx by Jens Peter Hansen, R&D Manager, Exhaust Gas Cleaning at Alfa Laval

10:15 Coffee break and networking

10:45 Ports perspective on the usage of scrubbers by Edvard Molitor, Senior Manager Environment, Port of Gothenburg

11:15 CFD as a design and optimization tool for scrubbers by Svend Skovgaard Petersen, Project Manager, FORCE Technology

11:45 On board measurements of scrubber performance on vessels by Tadeusz Borkowski, Doctor inz, Maritime University of Szczecin

12:15 Lunch and networking

13:00 Departure for DFDS Primula Seaways – Scrubbers in action

13:30 Welcome on board DFDS Primula Seaways

13:40 SECA and the choice of DFDS by Martin Larsson, Traffic Manager, DFDS

14:05 DFDS Primula Seaways and Scrubbers Guided tours on board the vessel to the bridge, engine room etc

16:00 Q&A

16:30 Return to Gothenburg City Center

19:00 Joint networking dinner

Participants

There were 35 participants on the study trip.

The names of participants can be seen below.
(Those who have responded the e-mail questionnaire are underlined)

NAME	SURNAME	COMPANY/ORGANISATION
Alf	**Brodin**	**BrodinInfo**
Anders	Jensen	pureteq a/s
Anders	Höfnell	Lloyd's Register Group
Ann-Christin	Back	VEO Oy
Bjarne	**Timm**	**TORM**
Camilla	Svendsen	MDC - Maritime Development Center
Daria	Mróz	Port of Gdynia Authority S.A.
Dariya	**Gavrish**	**Lund University**
Edvard	**Molitor**	**Port of Gothenburg**
Erik	Bäck	City of Gothenburg
Eunice	**Olaniyi**	**Tallinn University of technology, Tallinn**

Gunnar	**Prause**	**Tallinn University of technology, Tallinn**
Helena	Martinell	Miljöförvaltningen Göteborg Stad
Jan	Boyesen	MDC - Maritime Development Center
Jan Eiof	Jonson	Norwegian Meterorological Institute
Jarosław	**Myśków**	**Maritime University of Szczecin**
Jens Peter	Hansen	Alfa Laval Aalborg A/S
Jesper	Arvidsson	MAN Diesel & Turbo
Johan	Mellqvist	Chalmers University of technology
Johanna	**Yliskylä-Peuralahti**	**University of Turku**
Johanna	Snickars-Nukamb	Wärtsilä
Katarzyna	Hlebowicz-Stanisławska	Port of Gdynia Authority S.A.
Magdalena	Masalska	Port of Szczczecin-Świnoujście S.A.
Martin	Larsson	DFDS
Martin	Frisell	BAUHAUS
Martin Laue	Brodersen	TORM
Paulius	**Rapalis**	**Klaipeda University**
Sari	**Repka**	**University of Turku**
Secil	Torun	ENGIE
Sina	**Atari**	**Tallinn University of technology, Tallinn**
Sofia	Pettersson	Rowaco AB
Svend	**Skovgaard Petersen**	**FORCE Technology**
Tadeusz	**Borkowski**	**Maritime University of Szczecin**
Torsten	Heid	Symbios Funding & Consulting GmbH
Vladimir	**Conde**	**Chalmers University of technologgy**

Questionnaire results

In order to assess the long term effect of the study trip and analyse the level of capacity building an e-mail questionnaire was sent out to all participants.

The questionnaire had the following five questions:

1. Was the knowledge you obtained during the study trip valuable to your organization? If yes, how?
2. Did the combination of presentations and a visit at a vessel with a scrubber installation provide additional value? If yes, how?
3. How have you used the knowledge you obtained during the study trip during the last 12 months?
4. Have you been in contact with the network of persons that you met during the study trip in the past 12 months? If yes, how?
5. Do you have suggestions for how to improve study trips in the future or interesting topics to address?

14 out of 35 participants have responded to the questionnaire, which we find to be acceptable. However, most persons which have responded represent universities and it would therefore have strengthened the general validity of the assessment and its conclusions if we have had more representatives from other parts of the maritime domain such as ship owners and producers of maritime equipment answering the questionnaire.

The main goal of the study trip was to give participants an overall theoretical and practical understanding of how scrubbers work which they can use in their professional work. The knowledge included scientific knowledge from e.g. measurements, practical knowledge from staff on a vessel operating a scrubber as well as knowledge from companies situated in different parts of the value chain of scrubbers such as ports and producers of maritime equipment.

In the following their answers to the e-mail questionnaire are presented and analysed.

Knowledge obtained during the study trip

Most participants said they had obtained quite beneficial knowledge during the study trip because they had managed to carry out the research on scrubbers which was very relevant. For some it was their first time seeing a scrubber so indeed it was an eye opener, which they really appreciated.

Participants also answered it was good that they had gotten the best in terms of technical information as they managed to hear the experts speak about the technology of scrubbers.

Some summed it up by saying that the knowledge gained during the study trip was “helpful in dealing with concrete cases of pollution identification and prevention.”

Participants also appreciated how the trip was structured as they managed to freely ask questions and get answers to all the questions they had.

Some said the study visit was quite relevant in their own studies, saying that although they had information about scrubbers; they managed to expand their knowledge.

All respondents have answered that they obtained increased knowledge on scrubbers during the study trip. The participants had different knowledge levels prior to the study trip, but in general most participants had only little or basic knowledge. The study trip gave them a good overview and overall picture of the technology as well as an in-depth knowledge of critical thinking points such as the need for training, the actual size of scrubbers and the complexity of the systems. 12 months after the study visit many of the participants had used the knowledge directly in their work in order to e.g. write project proposals, benchmark scrubbers to other possible solutions as well as to teach and write articles. Some have only used the knowledge indirectly since it gave them the ability to better understand issues related to scrubbers.

Combining theoretical knowledge with a visit on a scrubber vessel

The possibilities and challenges connected to the utilization of scrubbers are complex and cross disciplinary and it was therefore important to give the participants an overall understanding of the various aspects to be taken into account when considering whether to install a scrubber or instead opt for another sulfur abatement technology. The study trip combined knowledge from producers of scrubbers, with on board measurements from real life operations as well as practical experiences from the staff working on board a ship with a scrubber installation. The participants were asked if the combination of presentations and a visit at a vessel with a scrubber installation provide additional value to them. In the following, their answers are presented.

The combination of presentations and the study trip was quite appreciated by some participants as they said it gave them more insights into how they conduct their case studies. Value was also created as some participants wrote that they managed to link knowledge from the presentations to the study visit at the ship. They got to understand how a scrubber actually works, making it less abstract.

Johanna Yliskylä-Peuralahti wrote “Yes, because during study trips one can see how things work in real life and it is a good way to raise the interest towards the seminar and gain more participants. One can learn a lot more during a fieldtrip than simply being in a seminar.”

For a few, the study trip did not create much value as they had been on a scrubber installed vessel before, while some said the presentations were “old news”.

One participant answered that all participants did not have the same technical expertise; hence it was difficult to have discussions at sufficient knowledge level during the visit while on board.

Most of the participants have answered that the combination of presentations with a study has provided great value to them as it connected theory with practice experience. Those participants that had visited ships with a scrubber installation before the study trip only gained minor new knowledge from the guided tour. However, a lot of participants had not visited a vessel with a scrubber installation prior to the study visit thought they had worked with scrubbers in various ways and had some knowledge on scrubbers. Those participants gained significant knowledge and can be divided into two categories. One group that gained a holistic understanding of how scrubbers work by relating the knowledge they possessed before the study trip with the new knowledge from the guided tour and presentations. Another group that gained knowledge on specific issues such as pipings in the scrubber, energy consumption, the size of the installations etc. Participants were also generally happy to speak with the engineers on board the ship as well as the captain and deck officers in or der to learn from their experiences from operating the scrubber. This helped them gain a much better understanding of the actual challenges related to operations and some of the practical aspects of using scrubbers.

Capacity building

The participants were asked how they have used the knowledge they obtained in the12 months that followed the study trip, in order to assess the capacity building effect from the study trip. In the following chapter, their answers are presented.

Participants answered that they had managed to use the knowledge they gained during the study trip, to come up with research papers. For some, this visit managed to help them with project preparation.

Jarosław Myśków said “The acquired knowledge allows me to better understand the essence of the problem regarding assembly on the ship and operation of the installation. It allows me to prepare a chapter in a monography describing the complexity of the problem (design, assembly, used materials and process operating parameters).”

In general many of the participants have used the knowledge they gained 12 months after the study trip and the long term capacity building effect among participants therefore seems to be very high when considering that the study trip was a one day event. Several have used the knowledge in their research such as scientific papers, articles as well as project applications. Furthermore, individual participants have used it in order to improve services towards customers, gain knowledge on whether to invest in scrubbers or not, as well as write general articles and communication materials.

Network

One of the purposes of the study trip was to give participants contacts to other professionals and experts that are interested in or work within scrubbers. These contacts can be viewed as a network and can be an excellent tool to help participants gain additional knowledge within specific topics. The participants were therefore asked if they during 12 months after the study trip have been in contact with other participants in order to assess the networking effect. In the following, their answers are presented.

Some answered that the study trip managed to create necessary networks and they are getting so much contribution to their work. One participant said because of the people they met during the study trip, they managed to arrange a similar visit to another ship.

Participants also said there was not quite enough time but they have kept in touch with other participants and they have planned for company visits and meetings. For some participants, they are currently undertaking some projects with other participants and they are in constant communication on project results and feedback.

Some however said they had not created any networks while some said they had known some of the people prior to the study visit.

The majority of those that responded to the questionnaire have been in contact with persons that they met during the study trip 12 months after, since 8 out of 14 have in some way been in contact with other participants. The level of interaction varies a lot. Some have arranged additional visits at ships

with scrubber installations and meetings based on the contacts they gained, while others have sent request for information. In one case the persons are now working together in projects.

Possibilities for improvements

In order to assess how similar study trips could be improved in the future, and thereby increase capacity building effects, the participants were asked if they have suggestions for how to improve study trips. In the following their answers are presented.

Some suggested to have a scrubber manufacturing company study trip and one said a visit on a triple fuel ship or just an LNG ship would also be good. Others felt the presentations should also be made short and more captivating. Some participants said it was important to organize some practical study visits which are linked to some established events so as to have better attendance. It was also suggested by some of the participants that there was a need to include topics like electrical solutions and hybrids. Others suggested a study trip focused on sewage handling onboard - black and grey water where installations are few and also incinerators. Others also felt it would be good to get a technical description on paper together with some operating data of the scrubber and to also have a visit to another ship so as to make comparisons.

Some participants had suggestions on the project as a whole, saying while so much money has been used on scrubbers; it would be good to invest in cleaner fuel. And some also felt that future seminars and possibly educational trips on ships should meet current expectations in new solutions. It was also suggested that the LNG and the Scrubber seminars had to be combined for better comparison focus.

Overall the participants have several suggestions for additional topics and events and thereby interest in gaining additional knowledge. In general there is an interest for having similar study trips that focus on other clean fuels and energy carriers such as LNG, methanol, ethanol, LSFO, hybrid and batteries. Others suggest a visit to another ship with a scrubber installation in order to be able to compare or focus on other scrubber related issues and e.g. visiting a manufacturer of scrubbers and engines, or focus on waste water treatment from the scrubber system. Some would like to have a technical brief prior to such a study trip as an introduction, while others suggest having shorter presentations and a longer panel debate. Furthermore, there is one respondent that would like to have other attendees with a higher technical level and not focus so much on general scrubber related issues.

Conclusion

The overall level of capacity building that resulted from the study trip on scrubbers was high since most participants either gained a holistic understanding of how scrubbers work or gained in-depth knowledge on specific details during a one day study trip. These types of events therefore have a good cost benefit ratio if you compare the amount of time it takes to attend with the knowledge output.

For those participants that had been on study visits on board a ship with a scrubber prior to the study trip, the knowledge output from the visit seems to be small. However, for most participants the combination of theoretical knowledge with knowledge from practical experience was very positive and gave those much more insights than only having presentations.

Most of the respondents have directly or indirectly used the knowledge they gained during the 12 months after the event and in order to develop new services to customers, assess whether to invest in scrubbers, or research work such as writing papers, articles or project applications.

When it comes to support professional networking, 8 out of 14 had in some way been in contact with other participants 12 months after the study trip. This ranges from participants that have arranged additional visits at ships with scrubber installations or meetings to requests for information. In one case the persons are now working together in projects.

The main suggestion for additional topics and events is to have a similar study trip that focus on other clean fuels and energy carriers such as LNG, methanol, ethanol, LSFO, hybrid and batteries.