Nordic Council of Ministers

Workshop Report:

Nordic Action for a Transformation to Low-carbon Shipping

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Nordic co-operation
Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland, and Åland.

Nordic co-operation has firm traditions in politics, the economy, and culture. It plays an important role in European and international collaboration, and aims at creating a strong Nordic community in a strong Europe.

Nordic co-operation seeks to safeguard Nordic and regional interests and principles in the global community. Shared Nordic values help the region solidify its position as one of the world's most innovative and competitive.

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Foreword

Emissions from international aviation and maritime transport are projected to grow by 50–250% by 2050. Therefore, in the immediate follow up to COP 21 in Paris, Nordic climate and environment ministers have stated that, if this potential growth is not addressed, it will undermine efforts in other sectors to achieve the 2°C target. They also emphasized that they will continue to work through the IMO and ICAO to limit emissions from international transport.

The Nordic countries together own a significant part of the international shipping fleet. Maritime transport forms a considerable proportion of freight and passenger transport to and from these countries, which all have shipping companies, and the challenges the Nordic countries face are similar. This report builds on presentations and material developed for a workshop held at the World Maritime University in Malmø on 13 December 2016, which gathered together around fifty experts from academia, NGOs, and the public and private sectors. The project sought to explore opportunities for the Nordic countries to cooperate in intensifying work in the IMO, promoting the energy efficiency of vessels globally, and increasing the awareness and implementation of the IMO's decisions on energy efficiency.

The Faculty of Law of the University of Copenhagen, in cooperation with the Energy Institute, University College London, and the World Maritime University, carried out this project for NOAK, a working group of the Nordic Council of Ministers. The aim of NOAK is to contribute to the ambitious and effective implementation of the UNFCCC and its Paris Agreement, with a Nordic perspective. To this end, the group prepares studies and reports, conducts meetings and organizes conferences supporting Nordic and international negotiators in the UN climate negotiations.

April 2017, Oslo

Peer Stiansen
Chair of the Nordic Working Group for
Global Climate Negotiations (NOAK)

List of Abbreviations

CBG	Compressed BioGas
CCWG	Clean Cargo Working Group
CO_2	Carbon Dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPLC	Carbon Pricing Leadership Coalition
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GloMEEP	Global Maritime Energy Efficiency Partnerships Project
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
LBG	Liquified BioGas
LNG	Liquefied Natural Gas
MBM	Market-Based Measures
MEPC	Marine Environment Protection Committee
MTCC	Maritime Technology Cooperation Centres
NCM	Nordic Council of Ministers
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organization
NIB	Nordic Investment Bank
NOAK	Nordic Working Group for Global Climate Negotiations
NOx	Nitrogen Oxide
SPREP	Secretariat of the Pacific Regional Environment Programme
WMU	World Maritime University
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank

Summary

The Paris Agreement aims to hold the increase in average global temperatures to well below 2°C above pre-industrial levels, and to pursue efforts to limit it to 1.5°C,[1] but it does not refer specifically to emissions of greenhouse gases by the international maritime transport sector. This Report presents the findings of a project commissioned by the Nordic Council of Ministers through the Nordic Working Group for Global Climate Negotiations (NOAK) focusing on opportunities for Nordic countries to achieve a transition to low-carbon shipping globally, nationally and regionally. The Report is informed by a discussion paper released in November 2016 and a workshop convened in Malmö in December 2016, in which representatives of governments, businesses and the research community participated. The key findings of this Workshop Report are as follows.

Technology and finance

Promising technical and financial options are available to Nordic countries to support or lead a transition to low-carbon shipping. The Report presents these options in the form of a low-carbon road map for the sector (see Figure 1), which includes illustrative actions and outcomes concerning technological and operational measures, partnerships between the public and private sectors, and supporting policies and finance.

Public policy

Opportunities exist for Nordic countries to support and lead development of the public policies needed for transitions to low-carbon shipping. Internationally, Nordic countries are well positioned to lead efforts by the International Maritime Organization and others to define global targets for the sector and to build global ambition through partnerships with developing countries and flag registries.

Outside the IMO, Nordic countries can catalyze transitions to low-carbon shipping through actions including market-based measures in Nordic countries, support for private-sector standards, low-carbon targets for Nordic fleets, arranging dialogue between stakeholders, including financiers and charterers, showcasing innovative Nordic practices, and building Nordic-led global partnerships such as "climate clubs".

[1] Paris Agreement on Climate Change (Paris, 12 December 2015). Article 2.1 (a).

Collaboration

The actions described above are interdependent and interconnected. The success of a Nordic agenda for low-carbon shipping depends on the inclusion of all relevant stakeholders, the coordination of policies, and a holistic view of shipping and the important roles of Nordic governments, businesses and civil society within the sector.

1. Introduction

In September 2016, NOAK commissioned a project (*Transformation to Low-carbon Shipping*) to inform Nordic work on the implementation of the Paris Agreement in the maritime transport sector through the formulation of a set of suggestions for Nordic action.

Emissions of anthropogenic greenhouse gases (GHG) by the maritime transport sector are expected to grow by 50–250% by 2050 under a business-as-usual scenario.[2] While the Paris Agreement states that all sources of GHG emissions must be controlled, it does not explicitly mention international maritime transport. However, the new climate agreement that emerged in Paris – in particular the long-term goal to limit global warming and the treaty's ratchet mechanism – will affect the framework for the regulation of GHG emissions from shipping. The flexibility of the Paris Agreement leaves a space for regional and national initiatives to prompt and influence action internationally. There is a strong case for the Nordic countries to explore how to operationalize the Paris Agreement's temperature stabilization efforts in the shipping sector, thereby influencing the choices to curb emissions in the sector internationally.

As part of the NOAK project's activities, a workshop was held on 13th December 2016 at the World Maritime University (WMU) in Malmö with the aim of exploring options for action by Nordic countries on the issue of maritime transport and climate change. A Discussion Paper was released in preparation for the workshop containing a framework for the debate. A wide representation of Nordic stakeholders, including government administrations, NGOs, industry and academia, gathered for this one-day workshop to brainstorm and discuss the technical, economic, legal and policy aspects of the different options in plenary and parallel sessions. Workshop discussions focused on four themes:

- Ways for Nordic countries to identify, accelerate and contribute to International Maritime Organization (IMO) discussions on GHG emissions by the maritime sector.
- A road map for the decarbonization of shipping specific to the Nordic region.
- Specific technological and operational solutions for low-carbon shipping.
- The role of action outside the IMO, including private-sector standards and public regulatory initiatives.

[2] See Smith, Tristan W.*et al*. Third IMO Greenhouse Gas Study 2014, pp. 127–146.

The authors have translated the results of the workshop discussions into the present Report, which contains a list of suggestions for specific initiatives. Here we present an analysis of the options generated at the workshop in relation to the legal, political, economic and technical criteria. These suggestions are intended to form the basis of further consultations on specific Nordic projects designed to promote low-carbon shipping.

2. Options for Nordic action on low-carbon shipping

The set of options for Nordic action put forward in the report is organized around four main interlinked pillars, which were the respective focuses of discussions in four sessions of the Malmö workshop:

- Establishment of a Nordic road map for transitioning to low-carbon shipping (Session A).
- How public and private initiatives concerning low-carbon shipping can reinforce each other, and their interaction with finance (Session B).
- Definition of a GHG reduction target for the maritime sector internationally (Session C).
- Advancing action outside the IMO (Session D).

The analysis brings together short-term (suggestions for immediate action) and medium-term (suggestions for action to 2020) perspectives so as to facilitate the prioritization and understanding of relevant options and how they can be organized into a Nordic agenda (see Figure 1). The choice of timescales takes account of the fact that the recent approval of a road map for reducing GHG emissions at the 70th Marine Environment Protection Committee (MEPC) foresees an initial GHG reduction strategy to be adopted in 2018.[3] In the medium to long term (beyond 2020), developments internationally and regionally might transform the policy landscape, making some options more or less suitable than those discussed today in the present report.

2.1 A Nordic Decarbonization Road Map: Session A

In order to identify a Nordic road map to enable low-carbon shipping, two questions were used to frame this session of the workshop:

- What is the timescale of the transition?
- Which technologies and fleets can enable the transition, and how are they linked to the Nordic region?

[3] IMO, MEPC 70/WP.7 Annex 1.

Discussion of the first question demonstrated that the transition to low-carbon shipping was seen as a process lasting decades. Existing technology and infrastructure, in combination with the inertia associated with them (mainly due to their long asset life-cycles), make this a necessity for shipping both in the Nordic region and globally. This strongly interlinks, but is not incompatible with, the discussions concerning targets and levels of ambition (see Session C below).

The discussion relating to technologies and fleets was more involved. The conversation focused, and remained concentrated on, the questions of fuel and machinery. This contrasts with much of the previous discussion on this topic in other fora, which have concentrated on the role of energy efficiency in achieving increases in efficiency, thereby reducing fuel consumption and consequently GHG emissions from ships. The potential for renewable technologies (e.g. wind and solar) to supplement onboard energy supply was noted by many. However, it was pointed out that, even with these technologies, the need for an onboard energy store (e.g. liquid fuel or batteries) is likely to remain. The role of energy efficiency was not dismissed – it is still a part of the transition – but it was not seen by the wider group as the central process. This was instead seen in terms of a transition to fuels with decreasing and ultimately zero carbon intensities, including when assessed using a life-cycle perspective of the fuel "from well to propeller".

The discussions over machinery and fuels can be summarized as follows:

- The use of liquefied natural gas (LNG) in internal combustion engines is already being introduced, but as this is a fossil fuel with high operational non-CO_2 and upstream GHG emissions, it cannot provide a long-term solution. Two biofuel variants of LNG, liquefied biogas (LBG) and compressed biogas (CBG), were considered as potential future pathways, with some use already in buses and cars, but the success of both would depend on their price relative to other biofuels (expected to be higher than for lower grade bio products) and synthetic or electro-fuels (also called power-to-gas/liquids/fuels, i.e. fuels produced from carbon dioxide and water using electricity as the primary source of energy). Of relevance to the Nordic countries here is the fact that much of the now global movement towards LNG was initiated in the Baltic and associated Nordic countries. This demonstrates an important principle – that *fuel shifts need to start somewhere, and the Nordics have a good track record in this respect and therefore the credibility to lead*. Perhaps also, given that LNG can only be a near- or medium-term fuel for the shipping industry, it is now incumbent on the Nordic region to help identify how the sector can move on from this fuel before it finds itself at risk of creating stranded assets and technology lock-in. However, it should be noted that the LNG pathway can be a bridge technology and lead a low-carbon shipping sector if LBG is blended with LNG in increasing proportions over time. A major challenge associated with this pathway is the limited production potential of LBG produced from the anaerobic digestion of household, agricultural or social waste. The production potential of "renewable LNG" may increase if conventional LBG can be complemented by electro-fuels and bio-methane from the gasification of

lignocellulosic (woody) biomass. It should also be noted that, regardless of fossil or renewable methane, the use of these fuels is associated with a risk of methane leakage. Methane is more than 25 times more aggressive as a greenhouse gas than CO_2, which may be a reason in itself to move on from LNG.

- The use of biofuels, especially the transition from 1st generation biofuels (produced directly from food crops) to 2nd and 3rd generation (non-food crop-derived, including from algae) was seen as having a good potential to assist in decarbonizing shipping fuel. One attractive point for biofuels was the expectation that these would mostly be "drop-in" fuels needing little or no modification to existing infrastructure and machinery. It was also noted that there was good potential for synergies from the production of biofuels for other industries, for example, the use of "waste" streams from the manufacture of high-grade biofuels for aviation to create lower grade fuels for use in shipping. However, the general perception was that there would likely be limits to the supply of sustainable biofuels, and by association higher prices for them. *Significant here is the fact that there is good availability of biomass in several Nordic countries, especially for low-grade fuel manufacture.* This, in combination with the "drop in" nature of the fuels, suggests the excellent potential for including biofuels as part of a Nordic fuels road map. When it comes to introducing biofuels, the absence of standards currently that could be used to certify the sustainability of different biofuels was pointed out, and no marine-specific work on the definition of sustainable biofuels was being conducted at present. *An opportunity for Nordic action to join the "Roundtable on Sustainable Bioproducts" in order to address the current shortfall was identified.* A further step in implementation was to consider *Nordic calls for a relaxation of current IMO regulations associated with the transportation of biofuels.* This expensively restricts their carriage to chemical tankers if the blend is greater than 25% biofuel.
- The topic of synthetic or "e" (electro) fuels was also discussed. This involves the use of low-carbon electrical power in conjunction with an appropriate feedstock, to manufacture a low-carbon fuel. One example is hydrogen produced by electrolysis and either used directly, or processed further to manufacture hydrocarbons (e.g. methanol). Because one of the main drivers of the cost of e fuels is the electricity, *one Nordic advantage specific to these fuels is the availability in several countries of almost fossil-free and low-cost renewable electricity, particularly at times of oversupply (e.g. high winds in the middle of the night).* However, if used to make marine bunker fuels (which are not currently taxed), the taxation associated with electricity may need further consideration if this is to become competitive.
- In addition to "e" fuels, the concept of pure electricity was also discussed (e.g. stored on board in batteries). This technology was considered to have good potential for full energy provision on some ship types (endurance of up to ~6h is considered viable at current prices and technologies) and for partial provision, for example, when maneuvering out of areas sensitive to air pollution to others. Many

Nordic ports are starting to use or at least consider shore power connections and associated infrastructure to provide electricity to ships when in port. However, progress remains slow in other North European ports (e.g. United Kingdom), *presenting an opportunity for Nordic countries to play an ambassadorial role* in ensuring the increased uptake and standardization of shore power systems.

- Another recurring theme present throughout the discussions on machinery and fuels concerned the need for high-quality data (enabled through digitalization) that can measure and determine the performance of different technological and operational steps taken as part of the road map. The deployment of this data was identified as important primarily to improve the accountancy of CO_2 emissions associated with shipping in the supply chain and to create demand from shippers for low-carbon shipping opportunities. Related to this discussion of how data could be used to improve supply chains was a point raised by a ship-owner about energy efficiency being inhibited due to competition laws, which currently prevent discussions between competitors that could optimize the matching of cargos to specific ships. With a number of existing private schemes in place (e.g. the Clean Cargo Working Group) as well as forthcoming regulations (at IMO and the EU) on emissions and fuel reporting, this is a difficult space to navigate. However, several stakeholders called for a concerted *Nordic effort to understand the overlaps between data, supply-chain decision-making and competition law and the opportunities thus provided.*

In light of these activities, which could all produce technological progress as part of a Nordic and eventually a global decarbonization road map, a number of points were raised about how this could be done efficiently within the Nordic region and then scaled up.

As the experience with LNG shows, any road map for technological development can start with technology solutions that are first piloted or deployed within the Nordic region (domestically or regionally), where the smaller scales of deployment and the smaller size of ships reduce the risks and capital costs involved. This approach also builds on the track record of Nordic countries in piloting something and then bringing the evidence to the IMO to support it and successfully encourage global regulation.

For these development projects to take place*, several Nordic ship-owners within the group signaled their willingness to be used as a floating laboratory,* that is, to provide a platform and a sparring partner for smaller technology companies who potentially have land-based technology solutions that they are trying to adapt for deployment on ships.

However, there is a risk of thinking being too Nordic-focused, and there may well be advantages in looking at other associated regional groupings (e.g. the EU, states bordering the Baltic etc.).

In addition to thinking about a broader geographical definition within region, *there is an opportunity to develop road-map technologies in partnerships between Nordic and developing countries.* The concept involves working with a developing country partner to trial and develop a specific technology that can contribute towards the latter's decarbonization road map, before potentially scaling it up further either for Nordic or more general global use. Among the efficiencies involved are: 1) the fact that many

developing countries have lower electricity costs (cheap solar energy), and opportunities to access climate finance, and 2) that such activity could be aligned with the IMO's interests in technology transfers and capacity-building. The Nordic presence or association of a number of relevant institutions (e.g. Climate Technology Networking Centre in Copenhagen, a Finnish secretary of the Green Climate Fund) was also pointed out.

Overall, Nordic countries have several natural advantages: high levels of technological competence, experience in producing, handling and using biofuels, low-cost renewable energy, the co-presence of a number of key stakeholders involving ship design, ownership, equipment manufacturing and finance, and experience in designing policies that can help incentivize regional technological development (e.g. the Nitrogen Oxides (NOx) Fund in Norway).

2.2 Public/private initiatives and financing the road map: Session B

Following on from a session on the nature of the technological and operational interventions that could help decarbonize the shipping sector, this session discussed the ways of working that would enable this, focusing on how the sector's private initiatives and NGO activity could help accelerate adoption, and what new business models and structures might replace the current "business as usual" scenario. The session discussed these subjects not as alternatives to the idea of regulation, but as a complement to the regulatory process discussed in greater detail in sessions C and D.

Given that many shipping companies (including Nordic shipping companies) are family-owned businesses, which tends to imply an element of long-term perspective and interest, questions were asked about the role and incentivizing of these family businesses. One suggestion was that they could move beyond the traditional supplier/client relationship between ship-owners, shipyards and equipment manufacturers (OEMs) through the creation of *Nordic multi-stakeholder "clubs"* at which innovators could cooperate in creating and pitching solutions. One particular challenge associated with this is that conventional bank finance could still constrain the ability of these clubs to take early-mover risk, raising the need for new thinking regarding finance. For example, risk-sharing funds and reduced fairway dues for low-carbon projects could be used as incentives. Public co-finance was another way to increase ambitions and the readiness to rake risks. Stena Line serves as a Nordic example: supported by EU funding, it has converted one of its ships to run on methanol.

Building on the previous sessions' concept of developing low-carbon technologies and fuels in partnership with developing countries, the idea of *Nordic blended finance* was suggested. Nordic blended finance refers to the strategic use of development finance and philanthropic funds to mobilize private capital. One current shortcoming of this concept of using public and private funding to assist in innovation was the challenging transition of technologies between proof of concept and scale production. It was pointed out that, while public funding assistance to get to the proof of concept stage could produce successful trials, without mechanisms to subsidize further early

adoption, increasing the production volumes of a technology and the associated cost reductions was often not achieved. *Launching a Nordic public/private early-adoption support fund was suggested as a way to address this shortcoming.*

Parallels were drawn between the issue of decarbonization and a number of other big drivers that the industry needed to "wake up" to. These included:

- Smart industry and communities.
- Radical traceability and accountability.
- Collaborative approaches, especially to measuring efficiency and emissions.

This resonated with the need to move beyond ships and to develop a digital and physical low-carbon infrastructure for them. A good showcase was the Swedish Zero Vision Tool Initiative, which attempts to address and combine opportunities across both digital (e.g. data) and physical (e.g. ports) infrastructure. A further proposal to address this shortcoming was to replicate approaches in other sectors that can make the sector more accessible to disruptors and mixed perspectives, for example, a *series of Nordic (or wider) conferences on smart ports/cities and interactions between shipping and ICT.* The latter would align well with the points raised in session A regarding the role of data.

Highlighting other work that was already ongoing, the Clean Cargo Working Group (CCWG), which started as a Nordic initiative, demonstrates Nordic countries' track record of openness as an example of a scheme that was initiated within the region before being scaled up globally. Given the increasing number of "green" initiatives and associated groups, especially in the Nordic area, it was suggested that there was an opportunity for a *Nordic process of streamlining and connecting up initiatives*, particularly connecting shipping and ports initiatives with health and climate issues. Such an alignment could increase efficiencies and the potential for further upscaling. A further potential was to explore how such private initiatives interact with or even transition to the public initiatives discussed in sessions C and D. This identifies a field for further work on the *overlapping of Nordic private initiatives with regulations to provide examples of hybrid (public/private) governance* that could in due course be scaled up globally (e.g. by the IMO and the global private sector).

2.3 Defining an IMO target and level of ambition for the sector: Session C

The concept of defining a target – also known as *fair share*, IMO intended contribution or IMO long-term objective – has been a key component of the IMO debates. This target is crucial in guiding the development of further measures, whether they are energy efficiency standards or market-based measures (MBM), and it will provide the IMO with a clear vision for its own understanding and

communication to external bodies and stakeholders, not least the United Nations Framework Convention on Climate Change (UNFCCC).

The Nordic Council of Ministers (NCM) could potentially assist in furthering the emerging work on determining a "fair share" or long-term objective for maritime transport, in which Denmark, Finland, Sweden and Norway are already taking part. This support in setting a target for the sector at the IMO can be achieved through a number of actions:

- Through involvement in the debates to formulate the "level of ambition" and/or the criteria informing this.
- Through global leadership and diplomatic efforts to consult, seek input and obtain buy-in from a wider group of countries, thus building developing countries' support.

One pathway to influencing these processes includes building developing countries' support through capacity-building:

- With regard to this option, the IMO is currently undertaking two bottom-up initiatives focused particularly on developing countries: the Global Maritime Energy Efficiency Partnerships Project (GloMEEP), and Maritime Technology Cooperation Centers (MTCC). While falling strictly within the IMO sphere, though developed as a result of the funding and involvement of third parties, GloMEEP and MTCC are both global initiatives. They aim to assist developing countries in particular, both in the development of national strategies and legislation for reducing GHG emissions from shipping, and in the transfer and development of capacity in implementing low-carbon technologies in the maritime sector. Both of these initiatives, which were initially funded by the United Nations Development Programme (UNDP), the Global Environmental Facility (GEF) and the EU respectively, are in their infancy and will require support from developed countries in detailing the content of their programs, building collaboration and sharing resources. In this connection, Nordic countries *may like to monitor the evolution of these schemes and increase their involvement by taking on a leadership role*. There may also be opportunities to *use these programs as frameworks for exchanging best practices,* including both taking ideas piloted or trialed in developing countries and applying them to Nordic case studies, or contributing examples of Nordic best practice to programs in developing countries.
- Also, GloMEEP and MTCC can be *further strengthened through existing bilateral relationships* so as to help build capacity. This could ensure that a more progressive debate at the IMO can be achieved. In this regard, an analysis of the debate on agenda item 7 (GHG) at the MEPC 69 meeting last year shows that many developing country members of the IMO did not attend, let alone speak on the subject. This is in spite of the fact that many developing countries (especially the Small Island Developing States and Least Developed Countries) are key

stakeholders that are already experiencing the severe impacts of climate change. The NCM has the potential to support these developing countries in enabling their active participation in the debate, especially if it can leverage existing links. The Nordic countries could also further support the WMU, which was established by the IMO in 1984 to guarantee maritime education, especially for students from developing countries. The University is located in one of the Nordic countries, in Malmö, Sweden, which makes it natural not only for Nordic countries to share Nordic know-how with these students at the University, but also to support capacity-building in their own countries.

- Furthermore, the Nordic countries could *facilitate knowledge exchange outside of the IMO debates in London by undertaking a series of workshops and outreach activities* specifically aimed at the challenges developing countries will face in order to explore how these could be overcome to mutual benefit. These exchanges could include topics such as: Shipping, Transport Costs and Trade, Climate Mitigation and Sustainable Development Goals, Responsibility and Trade, or Challenges and Opportunities around Technology Transfer. This approach, of taking these workshops and discussions in settings outside the IMO, has the advantage of avoiding heated debates within the IMO, building cooperation among countries and, significantly, accelerating progress, which would otherwise be limited by the already crowded agendas at the regular IMO meetings.
- Here, it is interesting to look at the *International Civil Aviation Organization (ICAO) process, which offers a relevant example of defining climate measures*, in particular, transferring lessons learnt from how to reconcile differential and equal treatment when adopting climate measures for international aviation. This includes delving into what ICAO has done to mediate any divisions between developed and developing countries and to build support in the latter. For example, ICAO has conducted consultations in all regions, as well as capacity-building and providing financial assistance for developing voluntary action plans on emissions reductions[4] through ventures with the GEF and UN programs, but also with regional organizations such as the EU. Building this support led to the adoption of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) in October 2016.[5]

A second set of possibilities for Nordic action relates to *working with flag registries*: ships owned by Nordic countries are often flagged in third countries. An inspection of Clarkson's World Fleet Register reveals that more than 50 percent of the ships owned in Nordic countries are flagged in non-Nordic countries. At the IMO, where each country's significance is often related to the quantity of tonnage registered, it is often important to have the countries with tonnage (important flag registries) aligned to increase their chances of success in gathering support for a proposal or discussion. This

[4] See, http://www.icao.int/environmental-protection/Pages/action-plan.aspx

[5] ICAO, Assembly Resolution A39-3: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure Scheme.

was demonstrated recently at both the 68th and 69th MEPC sessions, where the Marshall Islands (the third largest registry in the world, and also an important flag registry for many Nordic countries) invited the IMO to consider an emissions target or fair share. However, many of the other large flag registries (Panama, Bahamas, Liberia, etc.) remained more skeptical of the concept, concerned what the implications might be for their ship-owners. This presents an *opportunity for progressive ship-owner communities supportive of GHG regulations, such as the Nordic community, to communicate their ambitions to their many flag registry contacts* and to understand how, in combination (i.e. owners and registries), might ensure the achievement of progressive, fair and IMO-led regulation on GHG.

2.4 Exploring action outside the IMO: Session D

In the absence of a reference in the Paris Agreement to the maritime sector, and in view of the slow progress at the IMO, individual actors can decide to pursue their own policies on tackling maritime transport GHG emissions, partially with the aim of pushing the adoption of regulation at the IMO and/or influencing particular aspects of the regulation. Such unilateral approaches might increase if significant action at the multilateral level remains out of reach. Nordic countries could explore these avenues through the adoption of instruments for shipping regionally and/or domestically, as well as through the promotion of private governance systems. However, although *regional and national action* can speed up progress, it is not without its caveats.[6] Thus, in order to minimize the legal and political risks that unilateral action may entail, it is important that such actions are perceived as legitimate and fair. As for *private governance*, the emergence of private standards and initiatives for tackling maritime transport emissions through voluntary action present crucial opportunities for the sector's transition to a low-carbon future.

- Nordic countries can demonstrate their commitment by *setting domestic transport policies and targets consistent with the Paris Agreement.* This is connected to developments in other modes of transport: one important backdrop to efforts to decarbonize shipping is developments in other modes of transport. This is especially important because some aspects of shipping (for example, short shipping by sea) competes directly with other modes of transport (road and rail freight), and because it may be possible to leverage the infrastructure and technology developed for other modes of transport requiring high energy density low-carbon fuels and energy storage for application to shipping (thus presenting an opportunity for synergies and efficiencies of scale). Examples of developments for similar "heavy duty vehicles" include hydrogen trains, hybrid trucks and

[6] Some successful examples of unilateral action include the Canadian Artic Water Prevention Pollution Act, the EU double-hull regulation. See, Martinez Romera, B. The Paris Agreement and the Regulation of International Bunker Fuels. *Rev Euro Comp & Int Env Law*, 25 (2) p 225–226.

electrification. Notable drivers of developments in other transport modes include the 2050 climate action plans, encouraged under the UNFCCC framework, which have seen a number of countries, cities and companies define their intended actions in conformity with the Paris Agreement. Germany,[7] for example, is intending to reduce transport emissions by 40% by 2030 (from 1990 levels), and Sweden[8] has adopted the objective of achieving fossil fuel-free transport.

- Nordic countries could explore reductions related to maritime transport as an area in which substantial ambitions might be achieved. *Regionally (EU) and nationally, Nordic countries could choose to pursue measures to include domestic maritime transport in their Nationally Determined Contributions (NDC)*, including the establishment of measures such as an emissions trading system (ETS) or a tax for shipping affecting the international proportion of maritime emissions (similar to the inclusion of aviation in the EU ETS).
- Nordic leadership could also be demonstrated by adopting *ambitious targets for Nordic fleets.* Mirroring the framework of the Paris Agreement, which aggregates a series of component member-state contributions (NDCs), international shipping (through either the IMO or private governance schemes) could encourage individual players in international maritime transport to volunteer their own targets for fleets over which they have some influence. Examples of the "components" that could take part are national ship-owners' associations (following the existing initiatives of Danmarks Rederiforening and Svensk Sjofart in launching initiatives on data and vision), flag registries, domestic fleets, or fleets associated with a particular NGO (e.g. CCWG). This could be done formally by proposing the idea in a regional or global forum to ensure a more comprehensive framework. Alternatively, this could be conducted informally by forming partnerships with other ship-owners, registries or countries, and encouraging them to partake in similar partnerships.
- Moreover, there is potential for *including and amplifying the voice of the financiers and charterers.* As well as flag registries and owners, important stakeholders in shipping's GHG future include the financial and charterer business communities. In the event of poorly designed regulations on GHG and a turbulent period during which shipping undertakes its own low-carbon transition, financiers could experience significant stranded assets and subsequent write-downs, while charters have to manage with highly volatile supply and sudden fleet obsolescence. With these risks ahead, the sooner these communities are more proactively involved the better. Nordic countries lead the world in shipping finance and chartering, and therefore they have a significant potential to encourage leadership, GHG-centric thinking and engagement in policy dialogue.

[7] See https://unfccc.int/files/focus/long-term_strategies/application/pdf/161114_climate_action_plan_2050_en_bf.pdf
[8] See http://www.government.se/government-policy/environment/fossil-free-transport-and-travel-the-governments-work-to-reduce-the-impact-of-transport-on-the-climate/

An interesting potential here is *to explore the reach of environmental clauses in charter contracts as a way to promote climate goals.*

- *Showcasing good Nordic practices*. Crucially, examples of good Nordic policies and instruments could be explored regionally, and then used as best practice internationally. An array of both public and private initiatives and instruments shows the increasing presence of hybrid regulation in the industry. Hybrid here means regulation by initiatives created by the industry itself, as well as regulation by governments and regional policy. Some alternative proposals are also available in a similar fashion to the NOx fund. Some of these Nordic examples include the Norwegian NOx Fund, which demonstrates the potential for smart mix instruments by combining a technology standard with economic instruments. Other examples include: 1) differentiated fairway dues for different NOx levels (Farledsavgift) in Sweden; 2) the incentivisation and/or promotion of LNG as an alternative marine fuel (a wide number of initiatives, e.g. in Finland and Norway) – an example of air pollutant reduction, not necessarily GHG control; 3. The Clean North Sea Shipping collaboration, a Nordic and European initiative to understand the current levels of different emissions in the North Sea area; 4) the Green Ship of the Future collaboration, a Nordic-initiated collaboration of universities and industry partners exploring the technologies that might comprise "green" ships in the future; 5) the Zero Vision Tool collaboration, a Swedish initiative for safer, more environmentally and energy-efficient transport by sea involving a wide range of partners; and 6) the Trident Alliance, a collaboration involving a large number of Nordic companies that are seeking to ensure high compliance with forthcoming regulations, especially the low-sulfur content of fuel regulation. Many of these initiatives could be extended internationally or used to provide examples to other regions of the initiatives, collaborations and instruments that could help progress towards globally increased ambition.
- *Exploring the potential of "Nordic climate clubs"*,[9] i.e. groups of actors, where alliances can be formed by Nordic countries and/or Nordic companies to pursue leadership and solutions in the area. These could include industry associations developing a specific technology, regulatory, climate labeling clubs, and/or coalitions for information sharing. Here the first two possibilities of climate clubs require more institutional requirements, i.e. more time and resources to set them up and are therefore are more suited for the medium term. In contrast, actions to build climate and environmental maritime transport coalitions can be pursued immediately. In fact, there are already a number of such groups in the Nordic sphere, so action will extend existing resources and arrangements. Here, Nordic action could focus on: 1. The mapping of existing initiatives in order to identify issues not covered, the potential for synergies between them, and how to make them more updated and efficient (actually being able to deliver some impact,

[9] See further on climate clubs, Stewart, R.B., Oppenheimer, M. and Rudyk, B. Building blocks: a strategy for near-term action within the new global climate framework. *Climatic Change* (2017). doi:10.1007/s10584-017-1932-1.

rather than being merely networking instruments); and 2. based on the results of the study, it might be advisable to establish larger coalitions bringing existing clubs together, which is already happening in other climate areas. This action would also require facilitating access to finance for the clubs to share knowledge and to support a lean but efficient institutional framework.

- Specifically, coalitions on market-based instruments are available at the World Bank (WB). The *Carbon Pricing Leadership Coalition (CPLC)* can play a role in promoting Nordic leadership in setting a price for carbon in the maritime transport sector. Some Nordic countries and companies are already partners, but other Nordic countries and stakeholders could also join to strengthen this initiative, which presents great opportunities for influencing and preparing for forthcoming regulation.
- Nordic action could also be aimed at *establishing, facilitating and strengthening funding mechanisms* in order to bring change to scale (private-sector finance, donors, development banks, climate finance and integrated pathways to scale). In this context, the possibilities provided by the Nordic Investment Bank (NIB) could also be explored. (Session B).
- In this connection, Nordic countries may want to *engage with regional organizations* (e.g. the Secretariat of the Pacific Regional Environment Programme or SPREP) and raise the profile of shipping in various climate and development fora (Session B).

3. Steps towards a Nordic action agenda on low-carbon shipping

Drawing on the results of Sessions A, B, C and D, the workshop highlighted the mixture of the logical actions, outcomes and challenges associated with the decarbonization of shipping. These are illustrated in Figure 1, which also depicts a number of immediate and medium-term (to 2020) needs, which are then listed in more detail in Table 1.

As can be seen from the four sub-topics above (A-D), there are many facets to the transition to low-carbon shipping. The details of how this multi-decadal transition and the role that the Nordic countries can play in helping to ensure an ambitious transition consistent with the urgency implied by the Paris Agreement require consideration of at least all of the above in parallel. The significance of emissions peaking early for reducing the rate of decarbonization required, and the agreed timescale of the IMO (initial GHG strategy to be adopted in 2018), mean that, if possible, many of the actions need to be started immediately.

The potential actions identified in this report will require additional detailed analysis for their implementation, including in relation to broader policy processes in the region, which is beyond the scope of the report. However, some crucial factors in moving forward with the Nordic low-carbon shipping agenda can already be highlighted here:

- *Action must be inclusive*, allowing the participation of industry actors, civil society, different national perspectives and synergies across sectors.
- Similarly, when considering measures for the transport sector, it is advisable that the Nordic countries regard the issue in *holistic terms* so as to avoid, for example, competition distortions between land and sea transport.
- *Coordination* of domestic transport policy with the regional and global levels.
- It is important to realize that *technology transfers could be combined with technological development* (political capital, funding and appropriate scale) as a way to increase the positive impacts of a given technology option.
- Crucially, there is an *ambassadorial role to be played by Nordic industry and environmental regulation*, including the associated potential for influencing developments in the direction of low-carbon maritime transport.
- In this connection, there is a significant role for the *NCM to play* as an igniter of and catalyzer for action. Here, further work and research could be carried out in the specific areas identified in this report, as well as on other issues that may emerge from forthcoming developments in the climate and IMO regimes.

Figure 1: Nordic Actions and Associated Outcomes towards low-carbon shipping

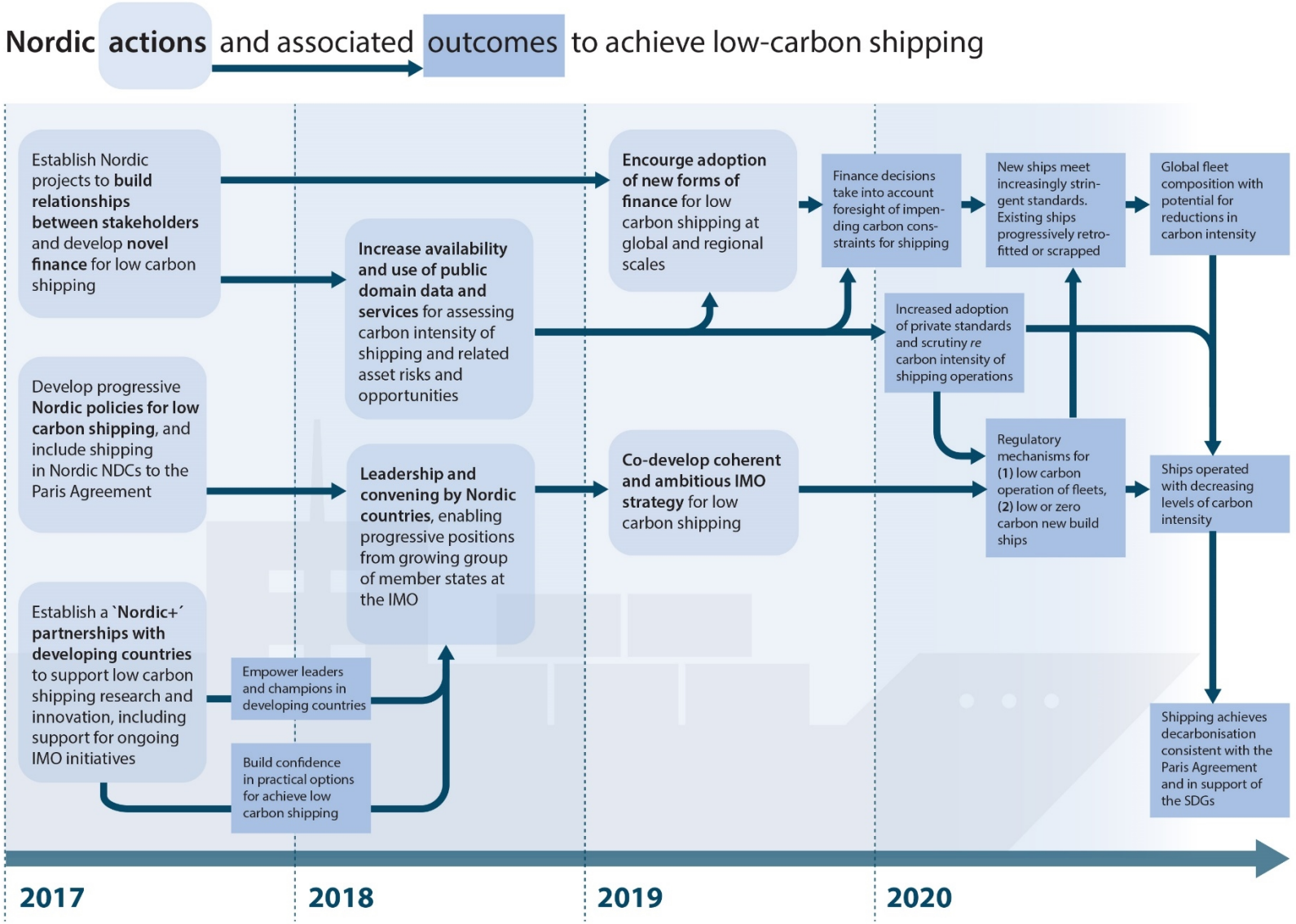

Table 1: Needs, associated actions and indicative timescales

Required outcome	Action	Timescale
Low and zero carbon fuels and technology ecosystem	Initiate a series of pilot projects to assist in developing low or zero carbon fuel production, bunkering and use in shipping. Leverage Nordic track record (e.g. experience in initiating use of LNG).	Immediate start Medium term continuation/ growth
	Make connections between shipping and energy sector in order to leverage notable Nordic advantage regarding biomass, especially for low-grade fuel manufacture, and the availability in several countries of low-cost renewable electricity, particularly at times with oversupply related to intermittency (e.g. high winds in the middle of the night).	Medium term
	Progressive legislation and standards to enable the use of bio or synthetic fuels in shipping, e.g. take the opportunity to join the "Roundtable on Sustainable Bioproducts" in order to address the current shortfall in maritime biofuel sustainability definitions. Support and advance Finnish calls for a change to current IMO regulations associated with the transportation of biofuels.	Immediate start
Addressing the barriers within existing stakeholder relationships	Encourage the formation of Nordic multi-stakeholder "clubs" on the decarbonization topic. Explore the potential to engage ship-owners to provide "floating laboratories" and ensure the involvement of financiers and charterers in these clubs. Work with flag registries associated with Nordic ship-owners. Explore the potential of a Nordic public/private risk-sharing fund to support early adoption and scaling up (e.g. step after pilot projects), including the financing possibilities provided by the NIB.	Medium term
	Undertake Nordic efforts to understand the overlaps and opportunities between data, supply chain decision-making and competition law, and share this with the Nordic and global communities.	Immediate start
	Undertake the streamlining and connecting-up of various private initiatives to measure and reward sustainability and decarbonization. Explore the overlaps between these initiatives with regulation to provide opportunities for efficient hybrid (public/private) governance.	Immediate start
Pursue synergies with developing country partners	Pursue the opportunity to develop zero-carbon road-map technologies in partnerships between Nordic and developing countries. Develop the concept of Nordic blended finance for use in developing and piloting zero-carbon technologies.	Immediate start
	Build developing-country support and capacity through capacity-building and bilateral relationships, including leveraging existing schemes and increasing involvement (e.g. MTCC/GloMEEP); use these programs as frameworks for exchanging best-practice. Further support the World Maritime University (WMU) and its students from developing countries by sharing Nordic know-how with them and supporting capacity-building in their countries.	Immediate start
IMO leadership, and leading by example	Active involvement in the debates to ensure a progressive "level of ambition" and the timely and ambitious completion of the IMO Initial and Revised Strategy on GHG.	Immediate start
	Take advantage of the opportunity to join the Carbon Pricing Leadership Coalition, and add Nordic experience of market-based measures to develop solutions appropriate for shipping.	Immediate start
	Set domestic transport policies that are inclusive of at least domestic shipping and are consistent with the Paris Agreement. Pursue the inclusion of domestic shipping in future revisions of NDCs.	Immediate start

Required outcome	Action	Timescale
Convening and ambassadorship	Develop a series of Nordic (or wider) conferences on topics that can bring wider interests into the shipping sector to help to address its GHG challenges. E.g. smart ports/cities, interactions between shipping and ICT. Facilitate knowledge exchange off-IMO, and undertaking a series of workshops and outreach activities (aligned with above actions) with the relevant stakeholder groups	Immediate / Medium term
	Perform global leadership and diplomatic efforts showcasing good Nordic practices.	Continuous

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Sammenfatning

Paris Aftalen (The Paris Agreement) sigter til at holde stigningen i gennemsnittet for temperaturer globalt et godt stykke under 2°C over niveauet fra før industrialiseringen og til at iværksætte indsatser, der begrænser stigningen til 1.5°C.[10] Paris Aftalen henviser imidlertid ikke specifikt til udledning af drivhusgasser fra den internationale søtransportsektor. Denne rapport præsenterer resultaterne fra et projekt kommissioneret af Det Nordiske Ministerråd gennem NOAK (Nordic Working Group for Global Climate Negotiations). Rapporten fokuserer på de nordiske landes muligheder for at sikre en overgang til transport med lav udledning af karbon på globalt, nationalt og regionalt plan. Et "discussion paper" udgivet i november 2016 samt en workshop i Malmø i december 2016 med deltagelse af regeringer, virksomheder og forskere har informeret rapporten. Dens centrale resultater omfatter følgende:

Teknologi og finansiering

De nordiske lande har lovende tekniske og finansielle muligheder til rådighed for at støtte eller lede en overgang til lav udledning af karbon for søtransport. Rapporten præsenterer disse muligheder i form af en handlingsplan for sektoren (se figur 1). Denne omfatter forklarende udspil og udkomme for teknologiske og operationelle tiltag, partnerskaber mellem private og offentlige sektorer samt anbefalinger og finansieringsmuligheder, der kan understøtte tiltag.

Politik på området

De nordiske lande har mulighed for at støtte og lede udviklingen af den politik, der er nødvendig for at sikre en overgang til transport med lav udledning af karbon. På internationalt plan er de nordiske lande placeret således, at de kan lede initiativer i regi af IMO (The International Maritime Organization) og i regi af andre institutioner. Sådanne initiativer kan definere globale mål for sektoren og forme globale ambitioner gennem partnerskaber med udviklingslande og flagregistre.

Uden for IMO kan de nordiske lande fungere som katalysator for overgangen til søtransport med lav karbonudledning gennem udspil, der omfatter markedsbaserede tiltag i de nordiske lande, støtte til standarder udviklet i den private sektor, mål for lavere karbonudledning for den nordiske flåde, facilitering af dialog mellem stakeholders, blandt

[10] Paris Aftalen, Paris den 12. december 2015). Artikel 2.1 (a).

andre finansieringskilderne og charters, samt opbygge globale partnerskaber anført af de nordiske lande, fx såkaldte "climate clubs".

Samarbejde

Udspil beskrevet ovenfor hænger sammen og er gensidigt afhængige. Et succesfuldt udkomme af en nordisk handleplan afhænger af, at alle relevante stakeholders inkluderes, at politik på området koordineres, og af anlæggelsen af en holistisk tilgang til søtransporten og de nordiske regeringers, virksomheders, og civilsamfunds vigtige roller for sektoren.

Annex I: Discussion Paper

Transformation to Low-carbon Shipping

A project from the Nordic Working Group for Global Climate Negotiations (NOAK).

Prepared by B. Martinez Romera, T. Smith, B. Milligan, K. Andersson and M. Grahn[11]

Summary

In September 2016, the Nordic Working Group for Global Climate Negotiations (NOAK) launched a project to inform Nordic work on the implementation of the Paris Agreement with regards to the maritime transport sector through the formulation of a set of suggestions for action. These suggestions could form the basis for specific Nordic projects in the future.

As part of the project activities, a workshop will be held on the 13th of December 2016 at the World Maritime University in Malmö, with the aim of exploring options for Nordic action on the issue of Maritime Transport and Climate Change. The outcome of the workshop discussions (Chatham House Rule[12] applies so as to encourage openness and the sharing of information) will be translated into a final report, containing a set of suggestions for Nordic action.

This discussion paper intends to inform the dialogue and debate at the workshop.

Context: Maritime transport emissions (contribution and scenarios)

Although maritime transport is one of the least energy-intensive modes of intercontinental transport and its contribution to the climate change problem is relatively small,[13] greenhouse gas (GHG) emissions from the sector are expected to

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[12] This means that participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.

[13] The Fourth Assessment Report of the Intergovernmental Panel on Climate Change shows that international maritime transport emissions accounted for around 2.7% of the global total in 2007, equivalent to an estimated 870 million tons of carbon dioxide (CO_2). Similar figures were provided by the International Maritime Organization, *Second IMO Greenhouse Gas Study 2009* (IMO, 2009). This study updated IMO, *Study of Greenhouse Gas Emissions from Ships* (IMO, 2000). A 2014 update showed slightly lower numbers for the period 2007–2012. IMO, *Third IMO Greenhouse Gas Study 2014* (IMO, 2014)

grow by 50–250% by 2050 under a business-as-usual scenario.[14] Importantly, maritime transport shows a great potential to curtail emissions through operational and technical options.[15] However, progress towards the regulation of these emissions has been limited to date, with existing measures not expected to be enough to achieve reductions proportionate to a 2°C pathway.[16] This makes the maritime transport sector increasingly politically visible, at a time when other sectors are reducing or limiting their emissions.[17]

Whilst the Paris Agreement[18] references that all sources of anthropogenic GHG emissions (e.g. including shipping) must be controlled, it does not explicitly refer to shipping. Arguably, this omission implies an opportunity for the International Maritime Organization (IMO) to lead on the development of regulation. A new regime for the control of GHG emissions has evolved as a consequence of Paris, which will, in turn, affect the framework for shipping's GHG emissions regulation, specifically the consequences of the long-term goal to limit global warming and the treaty's ratchet mechanism.

This weak and uncertain regulatory framework leaves space for regional/country level initiatives to prompt and influence action in the international sphere. There is therefore a strong case for the Nordic countries to explore how to operationalize the Paris Agreement temperature stabilization aims, and to influence the choices to curb emissions in the maritime sector at the international level.

Implementation of the Paris Agreement with regards to the maritime transport sector

In 2011, the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) was entrusted to develop "*a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all Parties"* for adoption at COP21.[19] Emissions from international maritime transport were part of the ADP negotiating agenda. An article referring to the maritime sector (also to international aviation) was kept in the negotiating draft until 9 December, three days before the closure of COP21.[20]

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[14] See IMO 2014 Study, at 127–146.

[15] See A. Bows-Larkin, "All Adrift: Aviation, Shipping, and Climate Change Policy', 15:6 *Climate Policy* (2015), 681.

[16] K. Anderson and A. Bows, Executing a Scharnow turn: reconciling shipping emissions with international commitments on climate change, 3:6 *Carbon Management* (2012).

[17] Lim, L., Lee, D., and Owen, B. *Shipping and aviation emissions in the context of a 2°C emission pathway*, Manchester Metropolitan University, Dalton Research Institute, Faculty of Science and Engineering, Manchester, UK.

[18] Paris Agreement (Paris, 12 December 2015).

[19] UNFCCC, Decision 1/CP.17 Establishment of an Ad Hoc Working Group on the Durban Platform for Enhanced Action (UN Doc. FCCC/CP/2011/9/Add.1, 15 March 2012), at paragraph 2.

[20] The draft article was included in the context of draft Article 3 on mitigation as follows: "*Parties [shall][should][other] pursue the limitation or reduction of greenhouse gas emissions from international aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively, with a view to agreeing concrete measures addressing these emissions, including developing procedures for incorporating emissions from international aviation and marine bunker fuels into low-emission development strategies*." UNFCCC, Draft Agreement and Draft Decision on Workstreams 1 and 2 of the Ad Hoc Working Group on the Durban

Although this article was not included in the final text,[21] the Paris Agreement is not without consequences for the sector's regulation of GHG emissions. While the Paris Agreement does not exclude any sector from its long-term mitigation aims (Articles 2.1(a) and 4.1), the mitigation instruments (countries' nationally determined contributions or NDCs) chosen to achieve these goals are not well-suited to address international transport emissions due to the difficulty to allocate emissions to specific countries. Thus, in this sense, the sector falls outside the Paris Agreement scope.

Nevertheless, the Paris Agreement modifies core aspects of the climate change regime and has implications on the regulation of GHG emissions from international maritime transport, mainly through the influence of a long-term climate stabilization objective and the commitment to progressively ratchet up ambition. In line with the UNFCCC's objective, parties to the Paris Agreement agreed to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and to pursue a 1.5 °C stabilization goal.[22] To achieve this goal, "Parties aim to reach global peaking of greenhouse gas emissions as soon as possible" and "to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century".[23] Therefore, allowing emissions from international maritime transport to increase would put at risk and contradict the aims of the agreement.

Consequently, parties could explore reductions related to maritime transport, which "remain areas where substantial ambition could be ratcheted up."[24] This could be done in a number of ways: First, at the multilateral level parties could pursue regulation under the UNFCCC regime and work through the IMO, which is by now been largely acknowledged by parties as the most suitable forum. In this connection, "domestic reactions to the long-term goal agreed in Paris might change countries' positions and ambitions, specifically, emerging economies and the US, facilitating the adoption of meaningful measures at the IMO."[25] Second, regionally and nationally. Here, countries could choose to pursue measures to include domestic shipping in their NDCs,[26] including the establishment of measures, for instance an emissions trading system (ETS) or a tax for shipping affecting the international part of maritime emissions (similar to the inclusion of aviation in the EU ETS).

Platform for Enhanced Action (3 December 2015), https://unfccc.int/files/meetings/paris_nov_2015/in-session/application/pdf/_adp_compilation_3dec15.pdf, paragraph 20

[21] Paris Agreement.

[22] Paris Agreement, Article 2.1(a).

[23] Paris Agreement, Article 4.1.

[24] E. Burleson, "Paris Agreement and Consensus to Address Climate Challenge', 20:8 *ASIL Insights* (2016).

[25] B. Martinez Romera, B. (2016). The Paris Agreement and the Regulation of International Bunker Fuels. Review of European, Comparative & International Environmental Law, 25 (2) pp. 215–227.

[26] S. Gota *et al.*, "Intended Nationally-Determined Contributions (INDCs) Offer Opportunities for Ambitious Action on Transport and Climate Change' (Partnership on Sustainable Low Carbon Transport, 2015).

Developments at the International Maritime Organization

In the IMO, discussions on tackling GHG emissions have revolved around three main pillars: technical, operational and market-based measures (MBMs) for the sector. In 2011, the Marine Environment Protection Committee (MEPC) agreed on two efficiency instruments[27] to be included in a new chapter of the International Convention for the Prevention of Pollution from Ships (MARPOL),[28] Annex VI. Also, a resolution on the Promotion of Technical Co-Operation and Transfer of Technology Relating to the Improvement of Energy Efficiency of Ships[29] was adopted in 2013. Prominently, earlier this year, the MEPC adopted a mandatory data collection system for fuel oil consumption,[30] which is considered to be a necessary first step towards a market-based mechanism at the IMO.

However, despite these accomplishments and ongoing negotiations on further technical and operational measures and cooperation in capacity building,[31] the IMO has thus far failed to agree on market-based measures (MBM), which are arguably crucial to achieve emission reductions in line with the 2°C objective.[32] In fact, the discussions on MBMs were suspended at MEPC 65 in 2013. However, the recent approval of a Roadmap for reducing GHG emissions at MEPC 70 might reopen the debate; the roadmap foresees an initial GHG reduction strategy to be adopted in 2018.[33]

Establishing a target or cap for the sector was debated at the IMO at the 61st session of the MEPC.[34] However, the issue was subsequently postponed at the MEPC 62–63 and was indefinitely postponed at MEPC 64.[35] Notably, at the 68th session of the MEPC a proposal from the Marshall Islands to set up a global sectoral CO_2 emissions targets for international maritime transport was put forward and put on standby until COP21. The concept of a target (also referred to as a long term objective, *Intended IMO Determined Contribution* and *fair share*) was discussed in a number of submissions to MEPC 69 and 70, but ultimately not explicitly mentioned in the Roadmap. Instead, the roadmap refers to the item "levels of ambition" which may be considered by some to be a proxy for a target.

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[27] Namely, the Energy Efficiency Design Index and the Ship Energy Efficiency Management Plan. They aim to promote innovation in the design of new vessels for energy consumption and to improve energy management, respectively.

[28] International Convention for the Prevention of Pollution from Ships (London, 2 November 1973; in force as modified by the Protocol of 1978, 2 October 1983).

[29] IMO, Promotion of Technical Co-Operation and Transfer of Technology Relating to the Improvement of Energy Efficiency of Ships (MEPC Resolution 229(65), 17 May 2013), Annex 4.

[30] 70th MEPC adopted mandatory MARPOL Annex VI requirements for ships to record and report their fuel oil consumption.

[31] Technical cooperation and transfer of technology for capacity building seek to raise awareness and provide training and assistance to developing countries to develop and implement national programs.

[32] See D.S. Lee *et al.*

[33] See, http://www.imo.org/en/MediaCentre/PressBriefings/Pages/28-MEPC-data-collection--.aspx

[34] IMO, Report of the Marine Environment Protection Committee on its Sixty-first Session (IMO Doc. MEPC 61/24, 6 October 2010), 43–44.

[35] See IMO, Report of the Marine Environment Protection Committee on its Sixty-second Session (IMO Doc. MEPC 62/24, 26 July 2011); Report of the Marine Environment Protection Committee on its Sixty-third Session (IMO Doc. MEPC 63/23, 14 March 2012); and Report of the Marine Environment Protection Committee on its Sixty-fourth Session (IMO Doc. MEPC 64/23, 11 October 2012).

Developments outside of the UNFCCC and the International Maritime Organization

Most notably, in 2015, the EU passed regulation so as to establish a Monitoring Reporting and Verification Mechanism for maritime transport.[36] This is part of a strategy of three consecutive steps towards regulating the sector's GHG emissions: 1) Monitoring, reporting and verification of emissions; 2) Establishment of GHG reduction targets for the sector; and 3) Establishment of further measures, including MBMs. Proposals are already on the table to consider what design such measures should have.

Whilst strictly within the IMO sphere, but developed as a result of funding and involvement of third parties, GloMEEP (Global Marine Energy Efficiency Partnerships), and MTCCs (Marine Technology Cooperation Centres), represent two emerging initiatives. They aim to assist particularly developing countries both in the development of national strategies and legislation for reduction of shipping GHG emissions, and in the transfer and development of capacity in low carbon technologies for shipping.

Other developments outside the multilateral arena include the emergence of private standards and initiatives for tackling maritime transport emissions through voluntary action. In a world where non-state actors play an increasingly prominent role, such measures present crucial opportunities for the sector's transition to a low-carbon future.

An important backdrop to efforts to decarbonize shipping refers to the developments in other modes of transport. This is because some aspects of shipping (for example short sea shipping) compete directly with other modes of transport (road and rail freight). Furthermore, infrastructure and technology developed for other transport modes requiring high energy density low carbon fuels and energy storage could be leveraged for application to shipping. Examples of developments for similar "heavy duty vehicles" include hydrogen trains, hybrid trucks and electrification. Notable drivers of change in other transport modes include the 2050 climate action plans, encouraged under the UNFCCC framework, which have seen a number of countries, cities and companies define their intended actions consistent with the Paris Agreement. Germany,[37] for example, is intending to reduce transport emissions by 40% by 2030 (on 1990 levels) and Sweden[38] has an objective of achieving fossil free transport by 2030.

Exploring Nordic action towards low-carbon shipping

Overall objectives of the workshop include consideration of:

- how the Nordic countries could help to identify accelerate and contribute to the IMO discussions on GHG emissions
- what a roadmap for decarbonization specific to the Nordic region might look like

[36] Regulation 2015/757- Monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC

[37] https://unfccc.int/files/focus/long-term_strategies/application/pdf/161114_climate_action_plan_2050_en_bf.pdf

[38] http://www.government.se/government-policy/environment/fossil-free-transport-and-travel-the-governments-work-to-reduce-the-impact-of-transport-on-the-climate/

- what some of the specific technological and operational solutions might be
- the role of action outside of the IMO (private standards/initiatives and public regulatory initiatives).

Defining a target (level of ambition) for the sector, and contributing to the Roadmap and GHG Reduction Strategy

The concept of defining a target – also known as *fair share*, IMO intended contribution or IMO long-term objective – has been a key component of the IMO debates. This target is crucial in guiding the development of further measures (whether they are energy efficiency standards or MBMs), and will provide the IMO with a clear vision for its own understanding and for communication to external bodies and stakeholders (not least UNFCCC).

The Nordic Council of Ministers could potentially assist in furthering the incipient work on determining a "fair share" for maritime transport, a process where Denmark, Sweden and Norway are already taking part in. This support to set a target for the sector at the IMO can be achieved not only through the involvement in the debates to formulate the "level of ambition" and or the criteria informing this, but also through global leadership and diplomatic efforts to consult, seek input and obtain buy-in from a wider range of countries, including gaining developing countries' support.

In this context, it is interesting to look at the ICAO process. In particular, transferring lessons learnt from the ways to reconcile differential and equal treatment when adopting climate measures for international transport. This includes delving into what ICAO has done to advance the developed/developing countries divide and build developing countries' support. For example, ICAO has conducted consultations in all regions, capacity building and financial assistance for voluntary action plans on emissions reductions,[39] through ventures with the GEF and UN programs, but also with regional organizations such as the EU. Building this support has remarkably led to the adoption of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) last October.[40]

Some of the ways to influence this process include building developing countries' support through capacity building, and working with flag registries.

With regards to the first option, i.e. capacity building, the IMO is currently undertaking two bottom-up initiatives, particularly focused on developing countries: GloMEEP and MTCCs. Both of these initiatives, which were initially funded by UNDP, GEF and EC respectively, are in their infancy and will require support from developed countries in developing the content of their programs, building collaboration and sharing resources. In this context, Nordic countries may wish to monitor the evolution of these schemes and increase their involvement. There may also be opportunities to use these programs as frameworks for exchanging best-practices (including both taking

[39] See, http://www.icao.int/environmental-protection/Pages/action-plan.aspx

[40] ICAO, Assembly Resolution A39-3: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme.

ideas trialed in developing countries and applying them to Nordic case studies, or contributing examples of Nordic best-practice to the programs).

Also, GloMEEP and MTCC can be further strengthened through existing bilateral relationships, so as to help build capacity. This would ensure that a progressive debate at the IMO can be achieved. In this regard, an analysis of the debate on the agenda item 7 (GHG) at the MEPC 69 earlier this year shows that many developing country members of IMO were not in attendance, let alone spoke on the subject. This is in spite of the fact that many developing countries (especially the SIDS and LDCs) are key stakeholders already experiencing the impacts of climate change. The Nordic Council of Ministers has the potential to support those developing countries since it has particular links to enable their active participation in the debate.

Furthermore, Nordic countries could facilitate knowledge exchange off-IMO, undertaking a series of workshops and outreach activities specifically aimed at the challenges developing countries will face, in order to explore how these could be overcome to mutual benefit. These exchanges could include topics such as: Shipping, Transport Costs and Trade, Shipping, Climate Mitigation and Sustainable Development Goals, Responsibility and Trade or Challenges and Opportunities around Technology Transfer. Taking these workshops and discussions off-IMO has the advantage of reducing the pressure on the debates, build cooperation among countries, and, significantly, accelerate progress, which would otherwise be limited to the 9-monthly meetings of the IMO.

A second option is to work with flag registries; ships owned in Nordic countries are often flagged in third countries. An inspection of Clarksons World Fleet Register reveals that more than 50% of the ships owned in Nordic countries are flagged in non-Nordic countries. At IMO, where significance is often related to quantity of tonnage registered to a country, it is often important to have the countries with tonnage (important flag registries) aligned for the success of a proposal or discussion. This was demonstrated recently both at MEPC 68 and 69 where the Marshall Islands (third largest registry in the world, and also an important flag registry for many Nordic countries) invited IMO to consider a GHG reduction target / fair share. However, many of the other large flag registries (Panama, Bahamas, Liberia, etc.) remained more tentative about the concept, concerned what the implications might be to their shipowners. This presents an opportunity for progressive shipowner communities, such as the Nordic community, to communicate to their many flag registry contacts, and understand how in combination (owners and registries) they can contribute to the achievement of progressive, fair and IMO lead regulation on GHG.

A Nordic Roadmap for a transition to low-carbon shipping

A starting point for a transition to low-carbon shipping would take account of an assessment of potential timescales and the implications for the maritime sector. Subsequently, a process of technology road mapping informed by a given objective, for example the decarbonization of the shipping industry over a 30-year timescale, could be developed. The road mapping would have to focus on the technologies/fleets that

can help enable this and assess how these are linked to the Nordic region (for example transition timescales for other transport modes and components of the energy system).

This process would lead to structured research and technology, trials and pilots to advance the transition to low-carbon shipping. UCL have spent the last six years developing the model GloTraM to enable the identification of technology roadmaps for shipping. Examples of this model's deployment include the development of possible scenarios for the marine fuels landscape (e.g. *Global Marine Fuel Trends*, and more recently *Low Carbon Pathways 2050*),[41] and a study for the Danish Shipowners Association[42] on potential decarbonization pathways and scenarios for the future of international shipping. Versions of GloTraM have also been developed for the IEA, for use in Shell, Rolls-Royce as well as for EBRD for the purpose of identifying and targeting relevant beneficial research and pilot projects.

Technology: opportunities and challenges for a transition to low-carbon shipping

Maritime transport shows great potential to curtail emissions through operational and technical measures.[43] Potential for technology in the Nordic region would entail establishing priorities through R&D, infrastructure and analysis of broader implications. Here, the role of private standards, regional and IMO policymakers in promoting technological change is crucial.

Importantly, opportunities can arise from research and pilot projects. In shipping, there are a large number of technologies that can create small gains in efficiency. Many of these are already well progressed, a few are at earlier development stages (e.g. air lubrication or wind propulsion) and could require further public funding and support.

Here, we identify some technology opportunities and challenges related to technologies: first, systems integration of multiple efficiency technologies in a single ship design remains a challenge, including the consideration of "real" operating profiles.

Second, wind assistance technologies (flettner rotors, sails, kites) show excellent potential on certain ship types. So far, only a limited number of trials have been undertaken and it is likely that further public funded work may be needed.

However, increasing energy efficiency and where possible substituting propulsion power for wind assistance will not achieve the full decarbonization consistent with the Paris Agreement, and a substitute is needed for existing fossil fuels. Electro fuels, renewable fuels and synthetic fuels will be required, but the wider energy system and infrastructure implications will need to be carefully considered. There is also a need to develop and scale the technologies used to produce, handle, store and consume these fuels, particularly at the volumes and power requirements associated with the international shipping industry.

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[41] http://www.lr.org/en/projects/low-carbon-pathways-2050.aspx

[42] CO_2 emissions from international shipping: possible reduction targets and their associated pathways.

[43] See A. Bows-Larkin, "All Adrift: Aviation, Shipping, and Climate Change Policy", 15:6 *Climate Policy* (2015), 681.

Marine-specific bioenergy products (e.g. low grade bioenergy products) have a good potential, but their land-use and life cycle implications will need to be considered, along with developments related to their production and infrastructure.

A consistent problem across many of these technological options is how the required investment and developments will be achieved, particularly during the current interim period during which the IMO is developing regulation.

Exploring action outside the IMO

In the absence of a reference to emissions from international shipping in the Paris Agreement and in view of the progress at the IMO, individual actors can decide to pursue policies on tackling maritime transport GHG emissions with the aim of pushing the adoption of regulation at IMO, and/or influence particular aspects of their regulation. Such unilateral approaches might increase if significant action at the multilateral level remains out of reach or is too slow. Nordic countries could explore this avenue, for example through the use of smart mix instruments for shipping at the regional level, and/or through the promotion of private governance. Although regional and national action can save the day, it is not without caveats. Thus, in order to minimize the legal and political risks that unilateral action entails, it is important that the action is perceived as legitimate.

In this connection, Nordic leadership could be shown through ambitious targets for Nordic fleets. Mirroring the framework of the Paris Agreement which aggregates a series of component member state contributions (NDCs), shipping could encourage individual components within international shipping to volunteer their own targets for fleets over which they have some influence. Examples of the "components" that could take part: National shipowner associations (following Danmarks Rederiforening's and Svensk Sjofart's existing initiatives on data and vision), flag registries, domestic fleets or fleets associated with a given NGO (e.g. CCWG). This could be done formally by proposing the idea in a regional or global forum to ensure a framework. Alternatively, this could be conducted informally by forming partnerships with other shipowners, registries or countries, and encouraging them to partake in the definition of similar contributions.

Moreover, there is potential in including and amplifying the voice of the financiers and charterers. Just like flag registries and owners, the financial and charterer business communities are important stakeholders in shipping's GHG future. In the event of badly designed GHG regulation and a turbulent period during which shipping undertakes its low carbon transition, financiers could see extensive stranding of assets and subsequent write-downs, whilst charters have to manage highly volatile supply and sudden fleet obsolescence. With these risks ahead, the sooner the communities positively engage and contribute the better. Nordic countries lead the world in ship finance and chartering, and therefore have a significant potential to encourage leadership, GHG-centric thinking and engagement in policy dialogue from these important shipping industry sectors. An interesting point here is exploring the reach of environmental clauses in charter contracts as ways to promote climate goals.

Crucially, examples of good Nordic policies and instruments could be explored regionally, and then used as best practice at the international level. An array of both public and private initiatives and instruments shows the increasing presence of hybrid regulation in the industry. Hybrid here means both initiatives created by the industry itself, as well as by government and regional policy.

Some of these Nordic examples include the structure technology port entry standard like the Norwegian NOx Fund, which shows potential for smart mix instruments, combining a technology standard with economic instruments. Other examples include: Differentiated fairway dues for different NOx levels (Farledsavgift) in Sweden; Incentivisation and promotion of LNG as an alternative marine fuel (wide number of initiatives) – an example of air pollution reduction not necessarily GHG control; Clean North Sea Shipping collaboration, a Nordic and European initiative to understand the current levels of different emissions in the North Sea area; Green Ship of the Future collaboration, a Nordic-initiated collaboration of universities and industry partners exploring the technologies that might comprise "green" ships in the future; Zero Vision Tool collaboration: a Nordic initiative for safer, more environmentally and energy efficient transport by sea, involving a wide number of partners; Trident alliance, a collaboration involving a large number of Nordic companies seeking to ensure high compliance with forthcoming regulations, especially the regulation controlling the fuel sulfur content.

Many of these initiatives could be extended internationally, or used to provide examples to other regions about which initiatives, collaborations, instruments, and combinations thereof, could help progress towards globally increased ambition in the decarbonization of the global shipping fleet.

Merger into a prioritization / set of areas for further focus

As shown in the discussions on each of the four sub-topics above, there are many facets to the transition to low carbon shipping. The details of how this multi-decadal transition and the role that the Nordic countries can play in helping to ensure an ambitious transition, consistent with the urgency implied by the Paris Agreement, require consideration of at least all of the above in parallel. Without trying to anticipate what the outcome of that final session, it will involve merging thoughts from each of the four areas and identifying what this identifies as the most obvious set of areas for further focus.

Annex II: Workshop Program

Workshop on Nordic Action for a Transformation to Low-carbon Shipping

Table 3: Programme

Time	Programme
08:00 – 08:30	Arrival and registration
08:30 – 08:50	Opening and Welcome and Keynote speech *Sasakawa Auditorium (ground floor)* *Mr. Peer Stiansen,* NOAK's Chair and Ministry of Climate and Environment, Norway *Dr. Cleopatra Doumbia-Henry*, President, World Maritime University
08:50 – 10:00	Plenary session *Sasakawa Auditorium (ground floor)* **International Maritime Transport and Climate Change: Exploring Nordic Action after the Paris Agreement** *Dr. Tristan Smith*, Bartlett School Environment, Energy & Resources University College London and *Dr. Beatriz Martinez Romera,* Faculty of Law, University of Copenhagen **International Maritime Organization Perspective** *Mr. Jesper Loldrup*, Head, Executive Office of the Secretary-General and of Policy and Planning, IMO **An industry perspective** *Ms. Helle Knudsen,* Senior Adviser, Department of Safety, Health, Environment & Innovation, Danish Shipowners' Association **Regulation of Greenhouse Gas Emissions from International Shipping and Port State Jurisdiction/Control** *Prof. Yoshifumi Tanaka,* Faculty of Law, University of Copenhagen
10:00 – 10.30	Coffee break

Time	Programme
10:30 – 12:30	Parallel Panel Sessions 1: **1.A. Nordic Roadmap for a Transition to Low-carbon Shipping** Chairs – *Professor Karin Andersson*, Division of Maritime Environment and Energy Systems, Chalmers Technical University of Sweden and *Dr. Tristan Smith*, Bartlett School Environment, Energy & Resources University College London Sasakawa Auditorium (ground floor) *Themes:* *Potential timescales for a transition to low-carbon shipping, implications for the sector* *What are the technologies/fleets that can help enable this and how are these linked to the Nordic region* *Speakers:* *1. Ms. Katharine Palmer*, Manager, Environment & Sustainability, Lloyd's Register *2. Mr.* Jussi Pyörre, Co-Founder and CTO, Eniram *3. Mr. Per Brinchmann,* Vice President, Wilhelmsen ASA *4. Mr. Sjors Geraedts,* Head of Business Development, GoodFuels **1.B. Defining a Target for the Sector** Chairs – *Dr. Beatriz Martinez Romera,* Faculty of Law, University of Copenhagen and *Dr. Ben Milligan*, Bartlett School Environment, Energy & Resources University College London *Room 335(third floor)* *Themes:* *Dimensions of the target: establishing a "fair share' for shipping at the IMO* *Building developing countries support* *Interactions and lessons from the ICAO process* *Speakers:* *1. Dr. Michael Mehling*, Executive Director of the Center for Energy and Environmental Policy Research at the Massachusetts Institute of Technology (MIT) *2. Mr. Simon Bennett,* Director Policy & External Relation, International Chamber of Shipping (ICS) *3. Mr. Sveinung Oftedal*, Specialist Director, Norwegian Ministry of Climate and Environment *4. Ambassador Moses Mose*, Solomon Islands
12:30 – 13:30	Lunch

Time	Programme
13:30 – 15:30	Parallel Panel Sessions 2: **2.A. Technology: Opportunities and Challenges for a Transition to Low-carbon Shipping** Chair – *Dr. Tristan Smith*, Bartlett School Environment, Energy & Resources University College London and *Dr. Maria Grahn*, Energy and Environment, Chalmers Technical University of Sweden *Sasakawa Auditorium (ground floor)* *Themes:* *Potential for technology in the Nordic region* *Establishing priorities: R&D, infrastructure and wider technology implications* *The role of private standards, regional and IMO policymakers in promoting technological changes* *Speakers:* *1. Mr. Huib van de Grijspaarde,* CEO, Koneksie *2. Maurice Meehan*, EMEA Transport and Logistics, BSR *3. Mr. Carl Carlsson,* CEO, Zero Vision Tool *4. Dr. René Taudal Poulsen*, Associate Professor, Copenhagen Business School **2.B. Exploring action outside the IMO** Chair – *Dr. Beatriz Martinez Romera,* Faculty of Law, University of Copenhagen and *Dr. Ben Milligan*, Bartlett School Environment, Energy & Resources University College London *Room 335(third floor)* *Themes:* *Smart mix instruments for shipping at the regional level* *The promotion of private governance* *Speakers:* *1. Adjunct Professor Bryce Rudyk*, New York University School of Law *2. Mr. Dirk Heine*, Fiscal Economist, World Bank, Global Climate Change Policy Team and Associate Fellow, Hoover Chair of the Faculty of Economic, Social and Political Sciences of the Université Catholique de Louvain 3. *Dr. Martin Cames*, Head of Energy & Climate, Oeko-Institut 4. *Mr. Faig Abbasov*, Aviation and Shipping Office, Transport and Environment
15.30 – 16:00	Coffee Break
16:00 – 16.50	Closing Panel (Report back from Sessions A and B with a view to merge into a prioritization / areas of focus position) *Sasakawa Auditorium (ground floor)* Chairs of the Sessions + NOAK's Chair

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Workshop Report: Nordic Action for a Transformation to Low-carbon Shipping

The Paris Agreement aims to hold the increase in the global average temperature to well below 2°C above pre-industrial levels (and pursue efforts to limit it to 1.5°C), but does not refer specifically to greenhouse gas emissions from the international maritime transport sector. This Report outlines the findings of a project commissioned by the Nordic Council of Ministers, focusing on opportunities for Nordic countries to achieve a transition to low-carbon shipping at national, regional and global scales. It is informed by discussions at the World Maritime University in Malmö in December 2016 between representatives of governments, businesses, NGOs and the research community. The Report presents a low-carbon roadmap for shipping with actions and outcomes concerning low-carbon technology, ship operations, finance, public policy, and public-private partnerships.

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