Shipping across the Arctic Ocean

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1. Project /publication	DNV (2010): *Shipping across the Arctic Ocean. A feasible option in 2030-2050 as a result of global warming?* Research and Innovation, Position Paper 04 – 2010. Oslo; Det Norske Veritas. http://www.dnv.com/resources/position_papers/shipping_arctic.asp
2. Initiator	The position papers of DNV are intended to highlight findings from their research programs. The project is apparently initiated internally. It appears to be a separate study, building particularly on results from the Norwegian Research Council funded project ArcAct.
3. Objective	To present scenarios for the shipping activities in the Arctic and related CO_2 emissions towards 2050.
4. Geographical delimitation	The maritime Arctic with the following details: Three versions of the NE-passage plus a direct route over the North Pole are considered for transit-traffic. Traffic across the North West Passage is not considered plausible due to navigability for large ships in the narrow channels. For simplicity in the model, the simulations are done between ports that are hubs representing wider areas of traffic: Rotterdam in Europe, and Tokyo, Hong Kong and Singapore in Asia. Petroleum-related ship traffic is only assigned to the NE passage since it is assumed that North American oil and gas will be exported by pipeline.
5. Time horizon	Results are provided for 2030 and 2050.
6. Thematic focus	The study focuses on two issues: • Shipping activities in the Arctic. Shipping is restricted to transit traffic between Europe and Asia of containerized cargo, and the ship traffic connected to oil and gas activities. Other types of ship traffic have been excluded. • CO_2-emissions from the activity The report ends with a brief presentation of some challenges from the foreseen increase in traffic, including governance responses.
7. Images of the future	The calculations for transit traffic are done for three scenarios - here used in a more technical meaning than in much of the literature on scenarios: • A baseline scenario with all traffic operating over Suez • Arctic Scenario 1 with all-year operation of 5000 TEU double-acting container vessels in a liner service • Arctic Scenario 2 with summer operation of 6500 TEU PC4 ice-classed container vessels Results across the scenarios show that Arctic transit will be economically feasible for part-year container traffic from the Tokyo hub, representing North Asia, in 2030 and 2050. Traffic estimates are 480 and 850 transit voyages, respectively, representing 8% and 10% of total container trade between the two continents. Due to shorter travel time and the need for a smaller fleet, CO_2 emissions are projected to be reduced by 1.2Mt annually in 2030 and 2.9 Mt in 2050, compared to the Suez alternative.

	For bunker prices over 900 $/ton, year-round sailing from North Asia may also be profitable. For central parts of Asia (Hong Kong hub), trans-polar shipping is likely to become marginally profitable only with high bunker prices and a long summer sailing season in 2050. The southern parts of Asia (Singapore hub) will have disadvantages of using the Arctic due to longer distances. If all the oil and gas developments assumed take place, total CO_2 emissions from the ships transporting the products will exceed the emissions from transit traffic by 40% in 2030 and approximately 100% in 2050.
8. Key driving forces	Ice conditions are discussed separately, and a possible scenario for 2050 is presented. This is based on the IPCC A2 scenario with modest reductions of CO_2 emissions compared to “Business as usual”, and the CCSM3 model of NCAR. The model applied for calculating shipping (see question 11), is dependent on several input-data. These include: trading volumes, geographic pattern of trade as opposed to the selected hubs, ice conditions, assumed speed reductions for the ships in ice-infested waters, ship size, shipping concept, length of sailing season, bunker prices, costs of building and operating ice-strengthened ships, future fee levels for shipping in Russian waters and emission factors.
9. Uncertainties/ wildcards	No particular wildcards are discussed. Sensitivity analyses on transit estimates have been performed with different assumptions about fuel prices and length of sailing season. Results are said to be robust. Uncertainties discussed are linked to assumptions and input-data for the model, see question 8. Future improvements of the model will try to incorporate variations in several of these input factors. The calculations of petroleum-related activities and emissions are said to be sensitive to changes in input variables such as the estimates of unproven resources (USGS), oil price, gas price, transportation mode, and fluctuating markets.
10. Accomplishment and collaboration	The study is expert-based. It is done by DNV alone, building particularly on results from the ArcAct project (partners: CICERO, UiO, NILU, DNV)
11. Method	Quantitative. Simulations of transit traffic are done by a model developed by DNV as a part of the ArcAct project. The model calculates costs for selected Arctic sea routes compared with the traditional Suez canal route. If the Arctic route is favourable economically, the model determines the number of passages and resulting emissions. Modelling of oil-related shipping activities are based on USGS estimates of resources. Future hydrocarbon production was estimated using a model called FRISBEE, with further calculations developed in the ArcAct project to achieve geographically distributed production volumes and export modes. That is apparently fed into DNV’s shipping model.
12. Sources of information	The report contains references in the text, but the reference list is only available on request. IPCC A2 scenario projections are used both for sea ice conditions and for global economic development; the latter as a basis for calculating sea borne container traffic between Europe and Asia. US Geological Survey (USGS) estimate of Arctic petroleum resources: http://www.usgs.gov/newsroom/article.asp?ID=1980&from=rss_home

	Several references to other studies that have tried to predict future Arctic transit shipping are provided at page 15.
13. Strengths	The project has a rather well documented quantitative approach to calculating future ship movements and emissions. It gives the order of magnitude of important parts of the future shipping activities, the relative importance of different developments (so far container and petroleum related traffic) and their sensitivity to underlying factors.
14. Weaknesses	It is important to bear in mind that this is a partial calculation of future ship traffic. Several other types of vessels, e.g. bulk ships, tourist vessels, fishing boats etc. are not included. A geographical limitation is the omission of American destinations from the analysis and the rough assumptions that exclude shipping developments totally in the NW passage. Such limitations must be taken into consideration when interpreting the results. Many of the assumptions in the analysis and the models can be discussed and still seem to be rough. It is necessary to improve model flexibility in the future to make it more realistic, and to set up more scenarios. This is apparently the intention of the authors. Rebound effects (increasing traffic volumes due to reduced transportation costs) should be accounted for. Soothing from emissions on the Arctic white surfaces with increased melting and eventually other specific Arctic effects, should also be taken into account. Both these factors will modify the conclusion on reductions in greenhouse gas effects compared to trafficking Suez. .
15. Attention and significance	Hard to assess.
16. Relevance for the Fram Centre	The project and the models applied are highly relevant for the activities in the Fram Centre.