

Prediction of CO2 Emissions from Ships

(A 1999 Nippon Foundation sponsored project)

. Research Objectives

The Ship & Ocean Foundation has long been involved in research on ship emissions, with its projects being sponsored by the Nippon Foundation, using officially sanctioned proceeds from boat racing. Among these emissions, carbon dioxide is a main contributor to global warming. Internationally, through the United Nations Framework on Climate Change, measures are being taken to reduce CO₂, while domestically, industry specific reduction goals have been set throughout the country to meet the national goal. CO₂ emissions from ocean going ships is a problem that will also be addressed on an international scale in future, but the Ship & Ocean Foundation has taken the initiative with its 1999 research into actual emissions conditions, as well as its predictions for future emissions amounts. It has also made preliminary investigations into future CO₂ reduction measures from both hard and soft-ware perspectives.

During the International Maritime Organization meeting held in London in October of this year, portions of this report were submitted to the Marine Environment Protection Committee, at its 45th session, where it was appraised highly by members of the committee.

. Abstract of the Research

1. CO₂ Emission Amounts from Ocean Going Transport

The results of the CO₂ survey show that of the 400 million tons of CO₂ (based on a CO₂ measurement) emitted each year by ocean going vessels, tankers account for 31%, bulk carrier ships 36%, and container ships 33%.

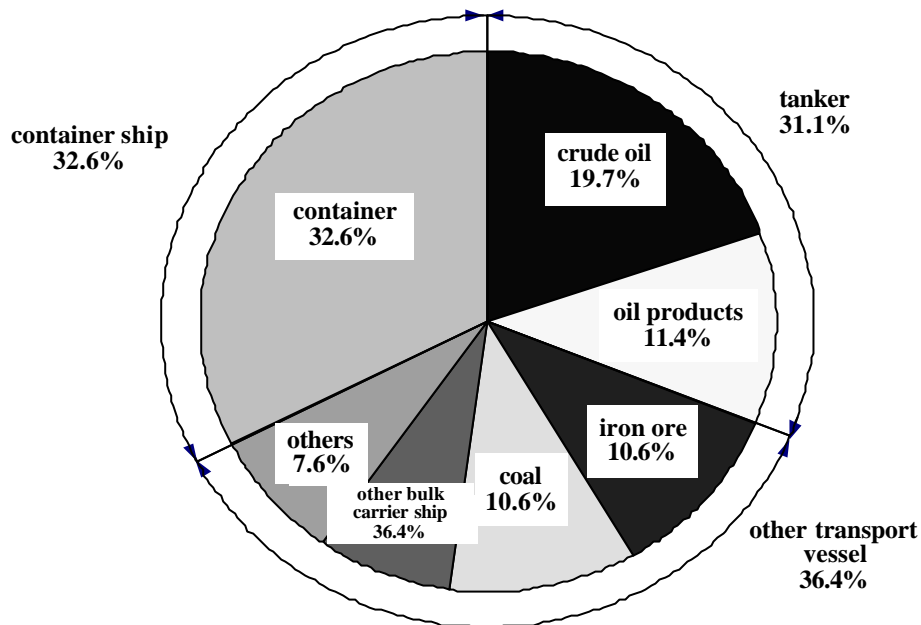


Figure 1. Ocean Going Transport CO2 Emissions : Ratio by Vessel Type (1997)

Total emissions of CO2 are 400 million tons (based on a CO2 measurement): derived from world transport patterns, vessel types, and bunker fuel consumed. Other Transport Vessels refers to ships unable to be classified.

2. Prediction of Future CO2 Emissions

(1) calculation parameters

Vessels were put in tanker, container ship, and other bulk carrier categories. Values were assigned as follows, and future emission predictions were made for each vessel type.

Increase in Transport Volume

| Vessel type | Transport volume ratio of increase | Notes |
|-------------------------|------------------------------------|--|
| Tanker | approximately 1% /year | Economic growth for OECD countries is 2% per year Energy conservation trends in OECD countries was taken into account in deriving values. Estimate based on actual transport of last five years. |
| container ships | approximately 6% /year | Estimate based on actual transport of last five years. |
| Other transport vessels | approximately 2% /year | Estimate based on actual transport of last five years. |

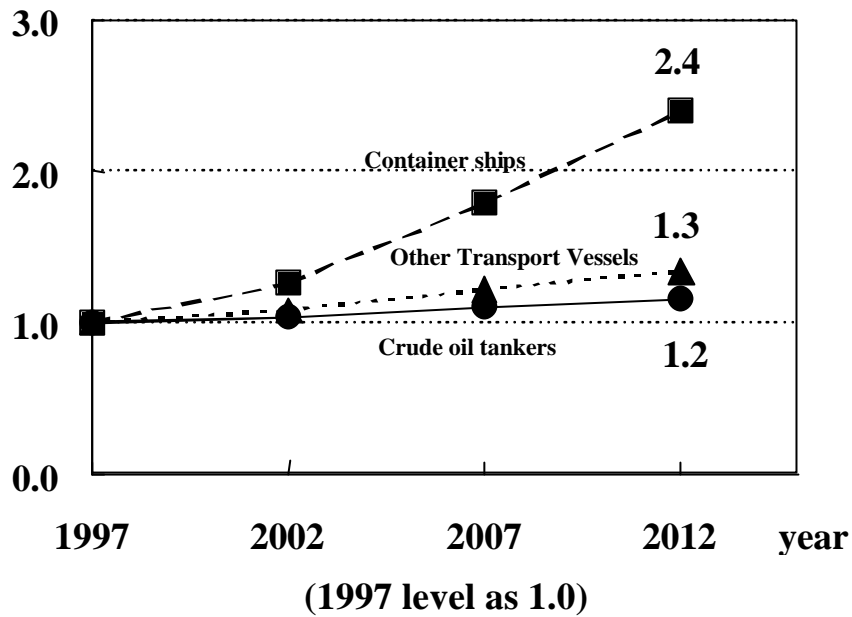


Figure 2. Prediction of Transport Volume Increase for Different Vessel Types

Replacement of aging ships: Ship life was set for thirty years and efficiency levels were set at current representative levels for each ship type.

Increase in number of ships: When the present number of ships is not sufficient to meet increasing transport volume, ship numbers were increased along with increase in transport volume.

(2) Prediction Results (2012)

Figure 3 shows a comparison between 1997 CO2 emissions and those predicted for 2012. In comparison with emission amounts of 1997, tanker emissions in 2012 are expected to decrease by 10% (14 million tons, based on a CO2 measurement), container ships are expected to increase by 11% (14 million tons, based on a CO2 measurement) and bulk carrier emissions are predicted to increase by 2% (2 million tons, based on a CO2 measurement). Accordingly, the figures show that CO2 emissions from ocean going vessels overall are expected to increase by 1% (4 million tons, based on a CO2 measurement).

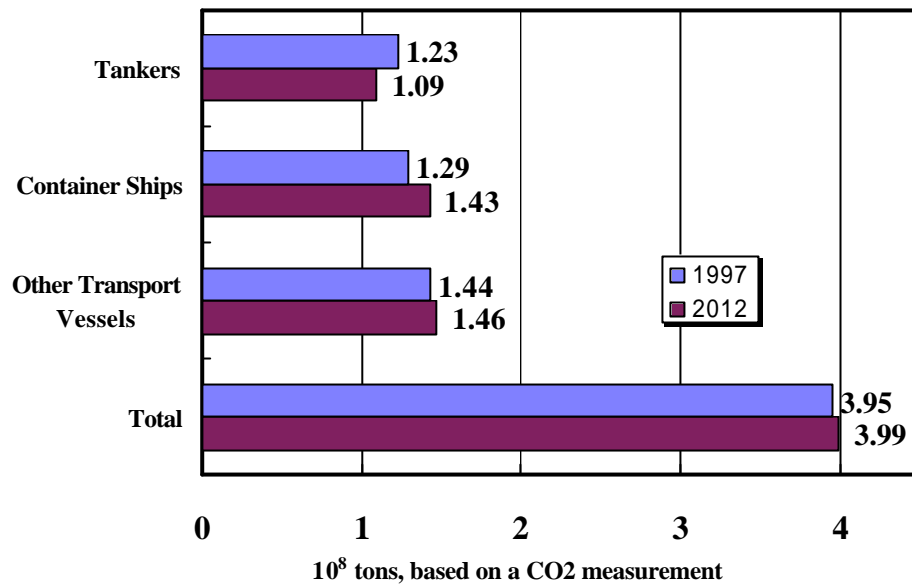


Figure 3. Comparison of Current CO2 Emissions and Predicted Amounts for Ocean Going Vessels.

Figure 4 shows trends toward the predicted amounts for 2012. For vessels other than tankers, CO2 emissions will increase along with an increase in transport volume. Tanker emissions will continue to decrease, compared with other vessel types, until 2002. This is due to the large number of tankers built in the seventies, which are now being replaced. After 2002, tankers will show an increase in CO2 emissions, along with other vessel types.

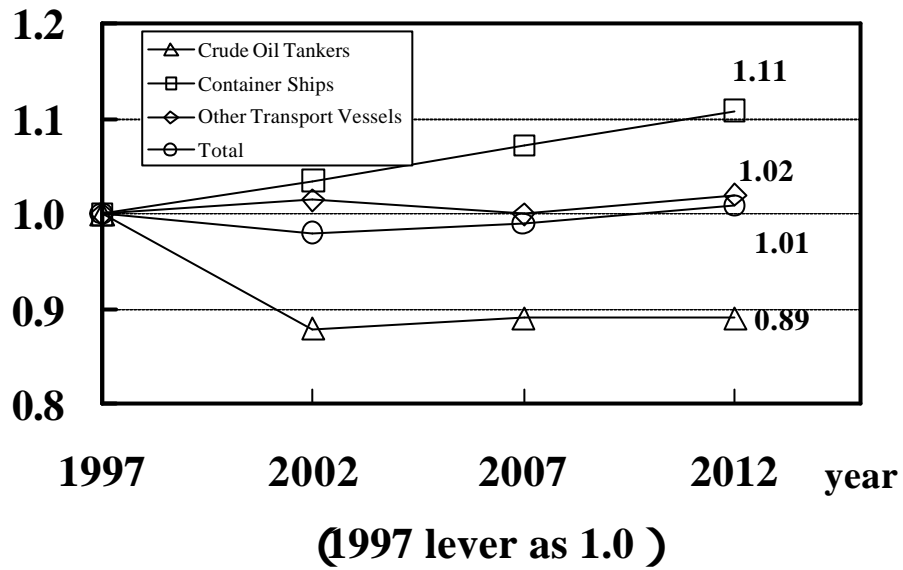


Figure 4. Predictions of CO2 Emission Trends for Ocean Going Vessels

Furthermore, for container ships and other bulk carriers, the ratio of increase in CO2 emissions is expected to be lower than the ratio of increase for transport volume. This is due to an increase in current average ship efficiency of 20-30%, compared with ships of thirty years ago.

3. Conclusion

In comparison with emission amounts of 1997, CO2 emissions in 2012 from ocean going vessels overall are expected to increase by 1% (4 million tons).

Container ships are expected to have an especially large increase in transport volume, with CO2 emissions expected to increase by 11% (14 million tons), in comparison with 1997, indicating a need for measures to be taken in regard these vessels.