Marine transport scoping meeting:

What are the barriers to obtaining cleaner and more efficient shipping?
25 July 2008

Report

Background: Energy and transport

The Research Councils' Energy Programme vision for energy and climate change research is to position the UK to successfully develop, embrace and exploit sustainable, low carbon and/or energy efficient technologies and systems to enable it to meet the Government's energy and environmental targets by 2020 and beyond.

The Programme's portfolio is strong in power generation and supply however, in order to contribute to the UK targets for reducing carbon emissions it needs to grow its portfolio in demand reduction and transport, as recommended by its Scientific Advisory Committee (http://www.epsrc.ac.uk/ResearchFunding/Programmes/Energy/AdviceConsult/ScientificAdvisoryCommittee.htm).

To reflect this, the Energy Programme has made commitment plans for the period 09/10 and 10/11 for a new programme of activities in energy and transport.

Advice

Our advisory body suggested we take a systems approach with this: looking at trade routes, shipping port locations; focussing not just on the ports or the ships themselves but their links with other modes (rail, air, road etc.).

The Department for Transport (DfT) have agreed a systems approach in this area, modelling supply chains, rather than looking at individual links in the chain. Their policy interest would be in measures which will lead to an effective reduction in CO_2 emissions either directly from shipping/ the supply chain or indirectly from offsetting/credits from other sectors.

This report is the output of a scoping workshop hosted by the EPSRC to answer the question:

What are the barriers to obtaining cleaner and more efficient shipping?

Stakeholders from the industry such as Lloyds Register, Marine Coastguard Agency and academics, including representatives from UKERC and Tyndall were asked to identify high impact areas (in terms of CO_2 emissions and energy demand) the Research Councils' Energy Programme could target a call in.

The challenges

There was a general feeling that there was a need for a fresh thinking in the area – there was a tendency to tweak what currently exists (e.g. looking for small increases in efficiencies) instead of redesigning a ship from scratch with sustainability issues in mind – e.g. design for less ballast water. This call was seen as timely as there is a lack of current work funded in the UK and with greater emphasis given to it from policy. For example, the International Maritime Organisation (UN specialised agency) are now moving from the SOx and NOx to the CO_2 issues and there is a hope to include shipping in the post-Kyoto agreements. As well as design issues, better logistics and port operations were also seen as high impact challenges.

The following paragraphs capture the thoughts of the workshop attendees on these challenges.

1. Design and Logistics

The challenge with potentially the highest impact (on the shipping emissions and energy demand) would be tackling the design and logistics issues together, but this was seen as the hardest to do. Working on either part in isolation could cause contra-productive results e.g. if a logistics solution meant a ship's engine was running at a level that it was not designed to, and therefore would be less efficient. Issues such as ballast water could be improved through better logistics (e.g. better routing) and designs (less volumes). However, the two taken separately would still have a high impact on their own – see below headings 2 and 3.

2. Design

Looking at the design issues, the group identified the following:

- *Design and technology gap analysis*: the group thought there was a disaggregated baseline analysis of the shipping sector in terms of international, coastline and inshore shipping.
- *Technologies and hull design/ship build*: There is a need for a technology and design gap analysis of marine shipping. What is the emissions reduction potential through design? Total emissions versus low fuel consumption.
- *Ballast water* (large bulkers spend 50% of their life in ballast); How to avoid ballast voyages through economic incentive schemes and other operational measures?
- *Retro-fitting*
- *Through-life issues:* All designs should be evaluated on a through life basis; looking at the life-cycle analysis of a ship and understanding the markets in which they are sold. This will ensure that any new initiative achieves the optimum environmental benefit and does not prioritise one (benefit) to the detriment of the other.
- *Looking at future scenarios*: 'What if?' queries of the future and how possible policy and technology interventions might have an effect on emissions and demand reduction.
- *Fuels*: Explore future marine fuels' effects on ship energy performance and emissions. Considering the energy density and their effect on storage; Are there lessons to learn from other sectors, such as the high performance car industry?
- *Ship building economics* - ships mostly built in Asia – how can this be influenced? A need for evidence-based regulation. How do shipping agents make choices? How do people innovate within a dynamic market? How do we build appropriate models? How do commercial contracts contribute to fuel efficiency?

3. Logistics and Port Operations

These have been taken together, however their impact was considered separately at the workshop. Logistics was seen as slightly harder to do but both had equal impact. Challenges highlighted were:

Container handling
Just-in-time
Reduction of waste/unnecessary operations
Decision making
Models that are appropriate
How shipping fits with supply chain and distribution (interoperability)?
Ballast water issues

- *Efficient port operations*: Decision making in a dynamic logistics system; Stream-line container handling, apply just-in-time (JIT) and land-logistic techniques to shipping. Look at a global transport management system. Competitive structure of supply chain (improvement of logistics chains for better utilization of individual ships)
- *The shore/ship interface*: Better connectivity and interoperability; Need for a systems model of how shipping fits into logistics supply chains/international distribution channels.
- *Cross-modal interaction (with rail etc.)*: Impact of total logistics value chain and of contractual arrangements. Decision making in terms of node (e.g. port) selection.

Issues:

i) No one knows where the true total 'costs' (economic, environmental) are in the chain (e.g. ships running empty).
ii) Contracts inhibit collaboration on environmental impacts.
iii) Selecting ports on economic basis alone may lead to longer journeys.
iv) Inefficient port operation leads to delays and ships waiting.
v) Need models to identify inefficiencies derived from logistics philosophies e.g. JIT and maximise efficiency of supply chain involving maritime sector.

4. Measurement and Apportionment

What is the impact of shipping now? We need to understand the scale of the problem and the future trends. The group thought there a need to develop better methodologies to do this and that more accuracy was needed with the data.

It was felt this was needed to gain knowledge and understand the scale of the problem and develop measures to decrease environmental impact to an acceptable level.

5. Demand aspects

It was thought that we should consider the impact of changing lifestyles and consumption patterns on shipping. Rising incomes have led to a large growth in passenger cruise lines and deep sea container traffic etc. and these sectors have important environment impacts.

There is a need to understand the future (unconstrained) growth in demand (and the resultant carbon footprints) with modelling and forecasting scenarios which could help inform appropriate responses (physical, regulatory, economic etc.). Shipping is changing so rapidly that today's behaviour is not a good predictor of tomorrow's behaviour.

6. Education and Human Factors

Education and communication was seen as an important element to greener shipping. Possible routes would be to have visiting lectureships from experts in the field at universities, working towards fulltime lectureships.

Naval architects, marine engineers and mariners cannot solve environmental problems if they are not aware of the issues and the legislative drivers are. There is little activity in this area at present and a future activity could involve Lloyd's Register, IMarEST, Maritime Environmental NGOs (e.g. WWF).

There needs to be a consideration of human element as a factor in efficient vessel operations. A need to investigate factors effecting/prohibiting masters from operating in the most efficient manor.

Conclusions

It was difficult to separate the different themes. The group felt there would be a great impact on the objectives of the Energy programme (CO_2 emissions and energy demand) if we looked at things in a very holistic view. A key one they thought was the combining of design issues with logistics. However, this would be a very ambitious call for proposals and more a sandpit-type of activity. The group agreed there would be value in looking at each of these individually.