الأبحاث المنشورة - (1994-2005) في مجال الطاقة والبيئة

للأستاذ الدكتور محمد عبد الفتاح شامة

Published Papers (1994-2005)

on Energy and Environmental Protection

by Prof. Dr. M. A. Shama

1- "A Projection on the Future Demands and Capability of Offshore Technology" A.M.R.J. (Egypt-1976), Shama, M. A.,. (100%)

2- "A General Outlook to Offshore Technology", Egyptian Society of Marine Engineers and Shipbuilders, Forth seminar, Alexandria, April, (Egypt-1983), Shama, M. A., (100%)

3- "Costs of C02 Abatement in Egypt Using Both Bottom-Up and Top-Down Appr", Energy Policy, (USA-1994)Yehia El Mahgary, A. F. Ibrahim, M. A. F. Shama, A. Hassan, M. A. H. Rifai, M. Selim, I. Abdel Gelil, H. Kokor, Anhar Hegazi, A. Amin, F. Bedewi and Juha Forsstrom, (8%)

4- "Estimation of GHG Emissions in Egypt Up to the year 2020", World Resource Review, Vol. 6, No. 8, (USA-1994), Yehia El Mahgary, VTT-Energy, A. I. Abdel-Fattah, M. A. Shama, Alexandria, Faculty of Eng., M. Selim, I. Abdel Gelil, Anhar Hegazi, NREA, Egypt, M. A. Rifai, Azhar University, A. Amin, F. Bedewi EEA, Egypt, and J. Forsstrom, (11%)

5- "Technical Evaluation of Transport- Related GHG Abatement Techniques", AEJ, April. (Egypt-1995), Shama, M. A., and Hassan, A. (50%)

6- "Ship Casualties Types, Causes and Environmental Impacts", AEJ, April. (Egypt-1995), Shama, M. A. (100%)

7- "Ship Structural Failures: Types Causes and Environmental Impact", AEJ, July. (Egypt-1995) Shama, M. A., (100%)

8- "GHG Emissions Inventory for Egypt and Emission Mitigation Options",VTT, Energy, (Filand-1995), Yehia El Mahgary, VTT-Energy, Finland, M. A. Shama, A. F. Ibrahim and A. Hassan, Alex. University, Egypt, M. A. Rifai, Azhar University, Egypt, I. Abdel Gelil, M. Selim and H. Kokor, ECPO, Egypt, Anhar Hegazi, NREA, Egypt, A. Amin, F. Bedewi EEAA, Egypt, and Juha Forsstrom, VTT-ENERGY,Finland, (8%)

9- "The problem of corrosion of ship structures", MARINES 96, Second Conference, Cairo, October, (Egypt-1996), Shama, M. A., (100%)

10- "Impact on Marine Environment of Ship Structural Failures and Casualties", AEJ, Jan., (Egypt-1997), Shama, M. A., (100%)

11- "Energy and Env. in Eng. Education", AEJ, Vol.36. (Egypt-1997), Shama, M. A. (100%)

12- "Energy and Environment Dimension in Ship Manufacturing Processes", PRAD's 2001, Sept., 8th Int. Conf. on Practical Design of Ships and other Floating Structures, (China-2001). Shama, M. A., (100%)

13- "Life Cycle Assessment of Ships", Alexandria Engineering Journal, AEJ, (Egypt-2004) Shama, M.A. (100%)

14- "Life Cycle Assessment of Ships", IMAM 05, Sept. International Maritime Association of Mediterranean Sea, (Portugal-2005), Shama, M. A. (100%)

15- "Environmental Dimension in the Ship's Life Cycle", MARDACON 9, December, Int. Con. "Towards a Cleaner and Safer Maritime Context", (Egypt-2005), Shama, M. A. (100%)

بسم الله الرحمن الرحيم

جمعية المهندسين البحريين ومهندسي بناء السفن
فبراير – 2009

ترشيدالطاقة والتأثيرات البيئية فى دورة حياة السفينة

Energy consumption and environment impact over ships life cycle

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The lecture addresses the following main items:

- **An overview of a ship's life cycle**
- **Ship design for energy saving and environment protection**
- **Energy demand and environmental impacts over a ship's life cycle, with particular emphasis on:**
  - **ship manufacturing processes**
  - **ship operation**
  - **ship recycling**
- **Conclusions**

A ship's life cycle is composed of:

- Ship design
- Fabrication, Construction and Outfitting
- Operation, Maintenance and repair
- Ship scrapping

***Life Cycle Assessment*, LCA, is used to evaluate and minimize *energy consumption* and *environmental impacts* holistically over the entire life cycle of the ship.**

Energy consumption of a ship over her life span

- Energy can neither be created nor destroyed.
- The whole energy consumed for power, light, or heat does not disappear, but is released to the environment, causing environmental destruction on a global scale.
- Among all other means of transport (trucks, trains, aircrafts, etc.), ships require less energy to carry and transport a given tonnage of cargo over a given distance.
- Therefore, with regard to energy consumption, ships are considered to be much more superior to other means of transport.

Main Factors affecting energy efficiency

- Using optimum ship dimensions, proportions and hull shape so as to reduce the installed engine power
- Lightweight construction
- Improving propulsion efficiency
- Using energy saving propellers– CRP
- Improving rudder and skeg design
- Rational selection of the sea margin

- Over-estimation of the percentage of sea margin could lead to unnecessary increase in the installed power of the main engines.
- This will have deleterious effects not only on the economy of ship operation but will also have increased negative environmental impacts.

Reducing fuel consumption by:

- **Using optimum ship dimensions, proportions and hull shape so as to reduce the installed engine power**
- **Improving propulsion efficiency**
- **Using energy saving propellers**
- **Improving heat recovery system**
- **Using solar energy and sail assisted ship propulsion**

The environmental dimension in ship design includes:

- Improving Energy efficiency
- Rational use of materials
- Protection of the environment by improving ship safety and reducing risk of marine accidents

SHIP SAFETY

Causes of casualties

- Technical deficiencies
- Environmental causes
- Human errors
  - Design
  - Construction
  - Operation
    + Inspection and survey
    + Maintenance and repair

Energy used in ship production

- **Direct energy**
- **Indirect energy**

The indirect energy is required for:

- **Production of steel plates and sections**
- **Manufacture of main and auxiliary engines**
- **Manufacture of ship equipment and fittings**
- **Production of welding electrodes, paints, etc.**

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Main Factors affecting shipyard productivity

Productivity = actual output/given input

- Labor skill
- Widespread utilization of standardization
- Quality of production planning
- Dimensional control
- Quality of fit between components
- Mass production of components
- Level of supervision
- Efficient material handling
- Optimize block size to suit shipyard transporter and crane capacities.
- Optimize structure to suit shipyard panel line and other facilities.

Measures of energy saving in ship hull fabrication

- Improving inter-process transportation
- Extensive use of design for production to reduce steel weight and cost.
- Reducing 2D and 3D bending & forming of plates.
- Maximization of down-hand welding
- Minimization of welding lengths
- Use large sizes of steel plates
- Improving accuracy of edge preparation
- Widespread use of computer-aided marking and cutting
- Maximization of outfitting work in block assemblies

Ship Recycling

- Ship recycling can be an economically and environmentally sound activity that contributes to sustainable development by providing jobs for workers, raw materials for construction, and economic incentives to recycle.
- Virtually every part of a ship – the hull, machinery, equipment, fittings, and even furniture – can normally be re-used.
- Currently, the commercial shipping industry has more than 90,000 vessels in service worldwide. By 2010, more than 4,000 ships could be recycled each year.

Environmental dimension in ship recycling

- The common normal ships life span varies between 20 and 30 years depending on several factors.
- The most important factor is the quality procedures adopted for maintenances and the frequency of its application.
- At the end of the expected life span of a ship, a condition assessment is conducted to take a decision on whether to continue to operate or to demolition the ship.

Environmental dimension in ship recycling stage

- **Energy consumption**
- **Pollution, Air, water and land**
- **Uncontrolled solid waste**

Ship recycling is becoming a big industry

- **Ship scrapping**
- **Ship demolition**

Solid waste management

Environmental protection in the recycling stage could be improved by the use of a solid waste management system which includes:

- Waste prevention by upgrading and Life extension
- Waste minimization
- Waste reuse
- Waste repair
- Waste recycle
- Waste incineration
- Waste landfill

Energy and environmental impacts over ships Life

- Energy consumption and environmental impacts over the various phases of ships life require proper assessment, quantification and analysis.
- The relative importance of energy consumption and release of emissions over the various phases of ships life indicate that a high percentage of the energy consumption and release of emissions occur during the operational life of a ship.

CONCLUSIONS

- **The shipbuilding and ship repair industries consume various types of energy and produce negative environmental impacts.**
- LCA of a ship could be used to identify, quantify and assess opportunities to:
  - Improve ship design
  - Increase cost savings by making more effective use of available resources
  - Minimize energy consumption
  - Reduce negative environmental impacts
  - There is a need to introduce Life Cycle Assessment into the Engineering educational system so as to improve environmental awareness among engineers.