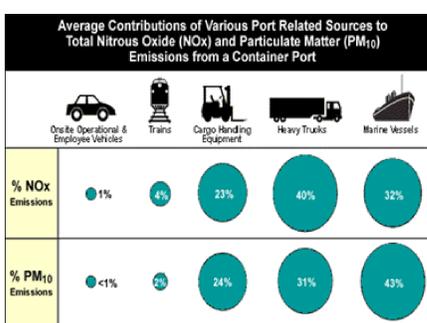


## SHIP-PORT INTERFACE AND ENERGY EFFICIENCY

### Ports' Functions and Complexities

- Port management is a complex process involving a chain of diverse organisations.
- Often different part of the chain are controlled by different players, thus decision making structure is complex.
- Ports provide:
  - Core services such as marine services, ship repair services and cargo terminal services.
  - Added value services such as general logistic chain services.
- No two ports are physically, operationally and economically the same.



Ship-related air emissions to port normally is less than 50% of total air emissions to ports from all sources.

### Port Related Activities

Marine services provided by ports include:

- Pilotage services:** Using services given by maritime pilots.
- Towage services:** Using tugboats services
- Line handling services by line boats:** For berth operation.
- Mooring services:** To secure a ship to the designated place
- Vessel traffic services (VTS) and aids to navigation:** Marine traffic monitoring and controlling.
- Control of dangerous goods:** To ensure safe handling.
- Waste management services:** Control of ships' waste aspects.
- Emergency response services:** Like services by fire brigade, etc.
- Control of dredging operations:** Dredging is usually carried out by private firms.

### Green Port Programs

Some ports implement comprehensive plans to reduce air emissions to ports not only from ships but also other types of in-port used vehicles and energy uses.

This is mainly advocated and implemented by a port authority with input from other stakeholders. Green Port Programs normally include:

- A set of specific emission reduction targets.
- A roadmap to achieve those targets.

To ensure success, a management system style continuous improvement cycle, based on Plan-Do-Act-Check, is normally applied.

To implement the program:

- Commitment by the management and staff of port authorities and regulatory agencies is essential for success.
- Monitoring, benchmarking and self-assessment need to be part of the implementation process.

As part of the program, ports normally provide incentives to ships to reduce their emissions during the port stays. A large number of ports in USA, Europe and Asia are currently implementing environmental programs.

### Environmental Ship Index (ESI)

- ESI is a ship benchmarking system developed as part of an initiative called the World Port Climate Initiative (WPCI).
- ESI is calculated via a formula that relies on elements that caters for NOx, SOx, CO2 emissions levels and OPS element if used by the ship.
- The ESI identifies seagoing ships that perform better than the IMO requirements.
- The ESI Score ranges from 0 (for a ship meeting IMO regulations) and 100 (for a ship that emits no SOx and no NOx and reports or monitors its energy efficiency).
- Currently the best performing ships score at around 40 points.
- Some ports provide incentives for ships that calculate and increase their ESI.

### Air Emissions in Ports

#### Sources:

- Cargo loading and unloading processes/devices.
- Trucks and other land-based transportation units.
- Buildings and building facilities.
- Harbour crafts/vessels.
- Ships calling at port.

#### Main emissions of concern:

- Nitrogen Oxides (NOx)
- Particulate Matters (PM)
- Sulphur Oxides (SOx)
- VOC (Volatile Organic Compounds) – Ports with oil cargo loading or unloading
- Some carbon monoxide and unburned hydrocarbons

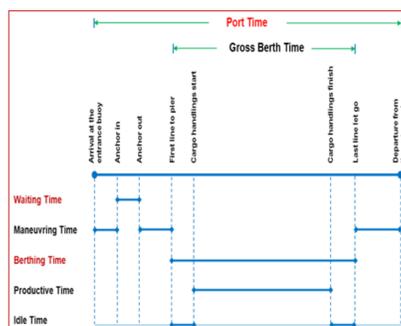
### Main Measures for Reduction of Ship-Related Air Emissions in Ports

- Just in time** operations of ships.
- Use of **clean fuels** by ships
- Use of **emissions abatement technologies** for ship engines.
- Ship-board energy efficiency** when in port.
- Use of **Onshore Power Supply (OPS)** systems.

### Time in Port (Port Time) for a Ship

Comprises of the following times:

- Manoeuvring time:** Manoeuvring to reach anchorage or berth or leave.
- Waiting time:** The period the ship waits for berth availability.
- Berthing time:** Actual time at berth. Berthing time consists of two parts:
  - Productive time:** Actual time from start of cargo handling operation to end of cargo handling operation.
  - Idle time:** Times in berth where there is no cargo handling operations.

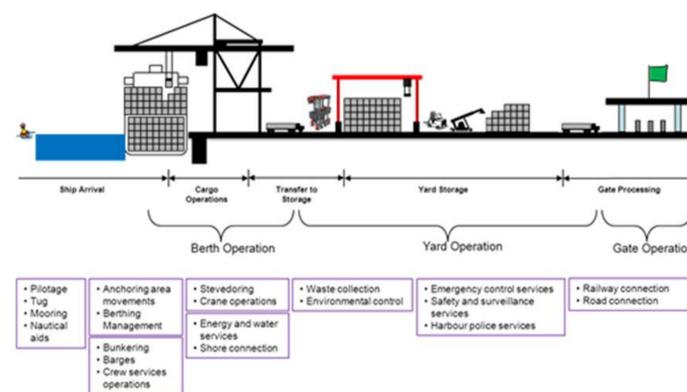


### Ship's Just In Time Port Operation

- This refers to any action that reduces the ship's idle time in ports via minimizing delays.
- 'Just-in-time' requires good early communication with port and harmonization amongst port-based parties concerned including berth availability, tug and pilot services and in time loading and unloading.
- Just in time port operation will facilitate the use of optimum or reduced ship speed, thus leads to significant reduction in ship's fuel consumption as well as reduced air emissions to port.

### Ship Port Time Levels

Ships spend a considerable amount of their lifecycle time in ports. This varies depending on ship type, ship size and generally comprises at least 25% of a ship's lifecycle time.



Ship-related and cargo-related activities in a typical container port terminal. Mainly includes berth operations, yard operations and gate operations.

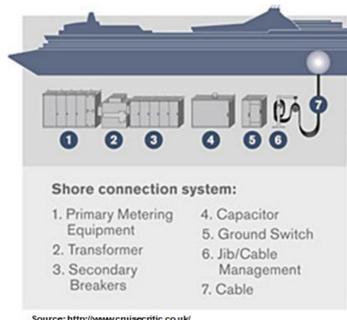
### Onshore Power Supply (OPS)

#### What is OPS?

- Supply of power from onshore (port) to ship.
- Allows ships to turn off their engines when in port.

#### Other names for OPS:

- Cold ironing
- Alternative Maritime Power (AMP)
- Shore side electricity
- Shore power



Source: <http://www.nisecitic.co.uk/>

### OPS and Energy Efficiency

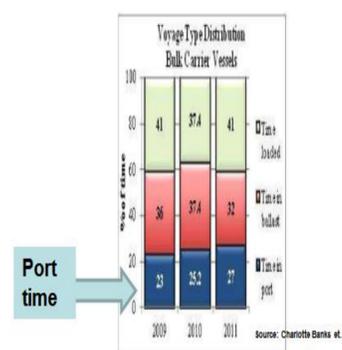
The overall energy efficiency of the OPS and also the cost of energy to ship-owner is not yet clearly established.

The OPS is likely to be beneficial from CO2 perspective if:

- Land based power generation is quite efficient.
- Low carbon fuel such as LNG are used.
- The above will vary from ship to ship and from port to port.
- For each case, there is a need for further investigation.

There is evidence that the overall cost of OPS electricity may be higher due to:

- Tax on OPS electricity.
- Base cost of electricity as supplied to ports may be high.
- Port charges in order to recover its capital and operational costs.



### OPS-Related Regulations, Standards

- There is no IMO regulations on OPS.
- The IEC, ISO and IEEE have joined forces and developed International standard "ISO/IEC/IEEE 80005-1 Cold ironing -- Part 1: High Voltage Shore Connection (HVSC) Systems -- General requirements" to standardise systems for global compatibility and safety.

### Ship Operation Measures in Port for Energy Efficiency

The main ship-board systems working when ship is at anchor or at berth include:

- Auxiliary machinery and equipment
- Diesel generators
- Boilers
- Cargo handling equipment; if fitted/used.

Thus, the main energy efficiency measures would be to minimise the usage of the above in ports. Examples are given below:

#### Auxiliary machinery examples:

- Minimising the number of A/C units operated when conditions permit.
- Reducing the number of engine room ventilation fans in operation as compared to sea-going condition.
- Review fuel treatment machinery usage and its reduction especially for long periods of port stays.
- Minimise the use of compressed air, where possible.
- Minimise the lighting loads.

#### Reduction of boiler use:

- Use of parallel operation of two boilers should be avoided.
  - Planning and optimisation of cargo discharge operation and ballast operation if they rely on steam driven pumps.
  - If boilers are used for Inert Gas generation, this aspect need to be managed
- Additionally, avoid use of two diesel generators where feasible via more effective auxiliary load reduction and engine power management.