

# **Mitigation of on-shore and near-shore pollution at ports and from vessels**

**- IAPH's initiatives to reduce emissions from ports -**



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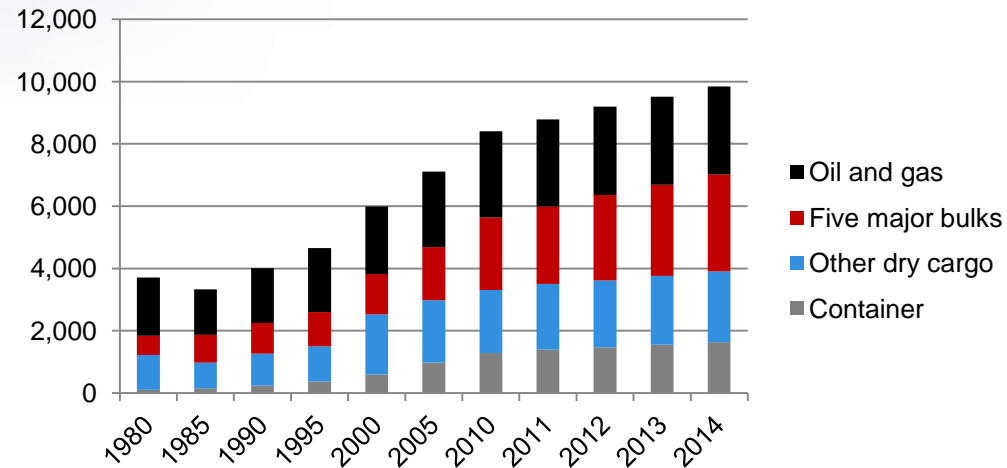


# World Seaborne Trade

## 1. World Seaborne Trade

(UNCTAD, unit : million tons)

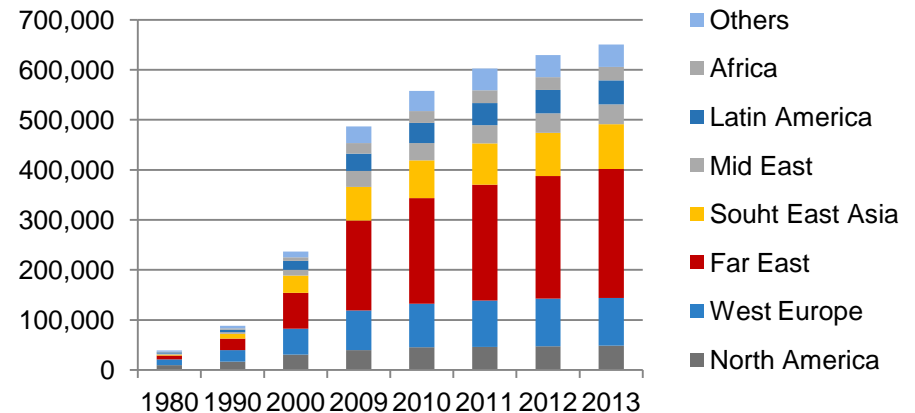
- World seaborne trade has increased steadily to reach 9.8 billion tons in 2014.
- Dry cargo has shown the strongest growth in these years.
- Container, in particular, has shown a tremendous increase during last 20 years.



## 2. Container Throughput by Region

(Drewry, unit: thousand TEU)

- The global container throughput reached more than 600 million TEU level.
- Far East Asia accounts for more than 40% of the total throughput in the world .
- Other Asian regions also show rapid growth.
- Developing countries/economies have increased their shares.
- Developed countries in Europe and North America have decreased their shares.





# IAPH and World Ports

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## 1. What is IAPH

- The International Association of Ports and Harbors (IAPH) is the only international association of port authorities in the world.
- It was established in 1955 and has been headquartered in Tokyo.

## 2. Members of IAPH

- The major members are port authorities.
- The Regular Member cover some 180 ports in over 90 countries, who handle nearly 70% of the world container throughput.

## 3. Consultative Status

- IAPH is given a Consultative Status as NGO from the UN organizations including IMO.

## 4. What IAPH is doing

- to organize World Ports Conference and other events and meetings.
- to publish “Ports & Harbors” magazines and other publications
- to carry out technical studies at the technical committees
- to study environmental issues through WPCI (World Ports Climate Initiative)





# Mitigation Measures at Ports and from Vessels

## - General Strategies -

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The following is an overview of effective strategies that can be taken to address gases emissions for each maritime operation.

- **Ocean Going Vessels**

- Vessel Speed Reduction
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Shore Power

- **Harbor Craft**

- Engine Replacement with Engines Meeting Cleaner Standards
- Clean Fuels
- Emission Control Technologies
- Electrification (including Shore Power and Hybridization)

- **Cargo Handling Equipment**

- Equipment Replacement with Engines Meeting Cleaner Standards
- Operational Improvements
- Clean Fuels • Emission Control Technologies



# Mitigation Measures at Ports and from Vessels

## - General Strategies - (2)

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- **Heavy Duty Vehicles – Trucks**

- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies

- **Duty Vehicles**

- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies

- **Locomotives and Rail**

- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies

- **Construction Equipment**

- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies





# Climate Change and IAPH

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## 1. Mitigation Measures

- WPCI (World Ports Climate Initiative) was created under the umbrella of IAPH in 2008.
- Eight (8) projects were set up.
  - Carbon Footprinting for Ports (web-based manual)
  - IAPH Tool Box for Port Clean Programs (web-based guidance documents)
  - On-shore Power Supply (web-based manual)
  - Intermodal Transport (still working)
  - Sustainable Lease Agreement Template (still working)
  - Cargo-handling Equipment (still working)
  - Environmental Ship Index (many ships and ports have already joined it)
  - LNG fuelled Vessels and Ports (safety check lists for LNG bunkering)

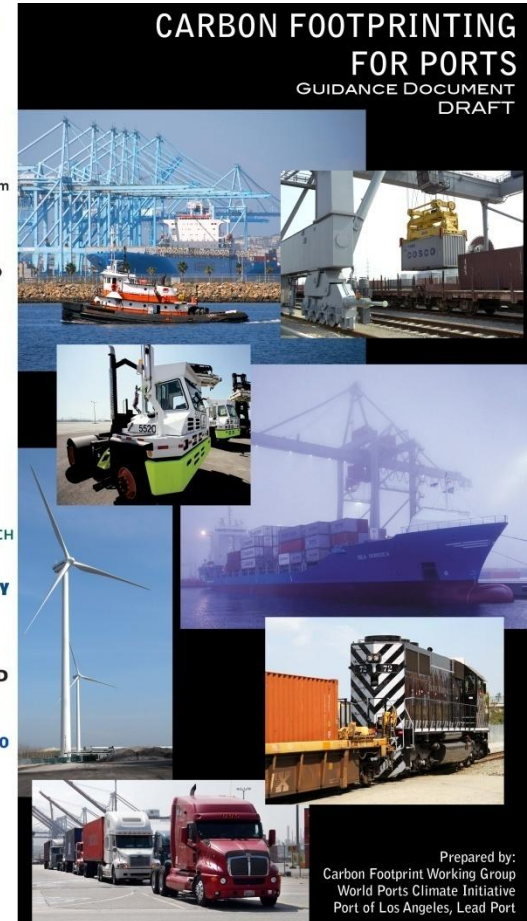
## 2. Adaptation Measures

- Some reports were published by IAPH such as “Climate Change Impacts on International Seaports” and “The Guidelines for Adaptation Measures for Seaports”, but IAPH still needs a lot of work on this in future.



# Carbon Footprinting for Ports

1. This is a manual for calculating the current gas emission level of a port.
2. It presents two approaches, a detailed approach and a surrogate approach.
3. The detailed one involves complicated calculations on how much gases emitted by all sources in ports such as ships, trucks, and handling equipment, and you may need to ask a consultant to carry out this.
4. The surrogate approach is simply to estimate the emission level of a port by referring to some calculated results of the other ports.







# IAPH Tool Box for Port Clean Programs

1. This “Tool Box” provides a variety of information on air and climate issues of ports and shows the users how to prepare a “Port Clean Program” for a port.
2. It was originally related to local gas emissions (Sox, Nox, and particulates), but later it was expanded to include additional tools on greenhouse gases (GHG, typically CO<sub>2</sub>) mitigation.
3. The users can prepare a clean air plan for their own ports by following the procedures presented in this web-based tool box.

## IAPH TOOL BOX FOR PORT CLEAN AIR PROGRAMS

Improving Air Quality While Promoting Business Development

A Reference Guide provided by the International Association of Ports and Harbors (IAPH)





# Clean Air Programs - Practice -

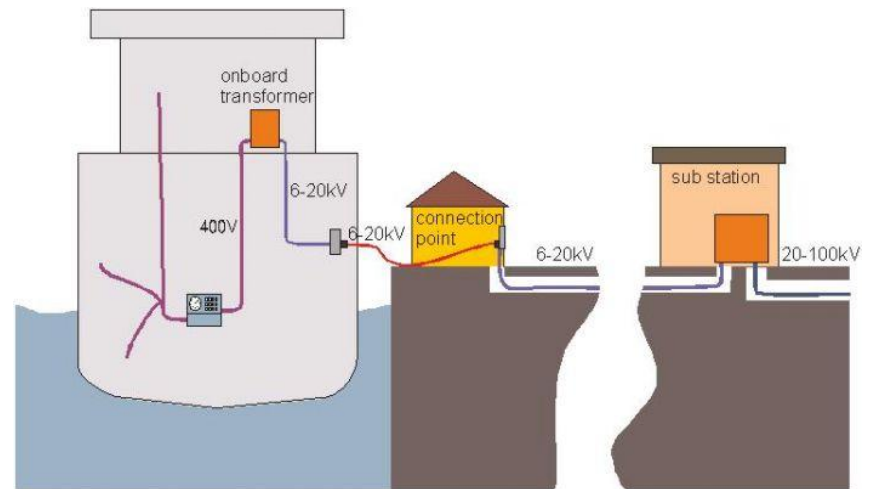
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1. The guidelines on “Carbon Footprinting” and “Clean Air Programs” were prepared under the strong leadership of the Port of Los Angeles.
2. The ports of Los Angeles and Long Beach, the US two busiest container ports, prepared one of the first and most aggressive environmental programs for reducing air pollution from port-related activities, which formed a basis of the IAPH Tool Box.
3. They jointly adopted “Clean Air Action Plan (CAAP)” in 2006 and updated it in 2010, and reduced pollution from the ships, trains, trucks, terminal equipment, and harbor craft operating in and around the ports according to the clean air action plan.
4. The Ports of LA and LB have achieved remarkable outcomes (2006 vs. 2015):
  - 82% drop in levels of diesel particulate
  - 54% drop in oxides on nitrogen (NO<sub>x</sub>)
  - 90% drop in oxides of sulphur (SO<sub>x</sub>)



# On Shore Power Supply

1. On-shore power supply is a system to provide electricity from the local grid to ships to meet their power demand.
2. As some ports have already taken this measures (US West Coast and North Europe), interests in the technology are rapidly growing.
3. With the newly revised OPS website, the users can carry out an initial feasibility study to introduce OPS at their own ports.





# **On Shore Power Supply - Practice -**

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- 1. There are currently 120 berths fitted with shore power connections in the world : 60 in North America; 50 in Europe; and 10 in the Middle East/Asia-Pacific.**
- 2. The new European Union directive, DAFI (development of alternative fuels infrastructure) wants to see shore power throughout ports in Europe by 2025.**
- 3. California demands that 50% of container and cruise fleets must now have shore power connections and must also cut emission by 70% by 2017 and 80% by 2020.**
- 4. In the mainland China, all new container, ro-ro, cruise and bulk terminals must have shore power in their plans.**
- 5. A question is “Are they financially feasible? ”  
(Some experts say the payback period of OPS is just several years, but some disagree to this. It all depends on the ports)**



# Environmental Ship Index (ESI) (1)

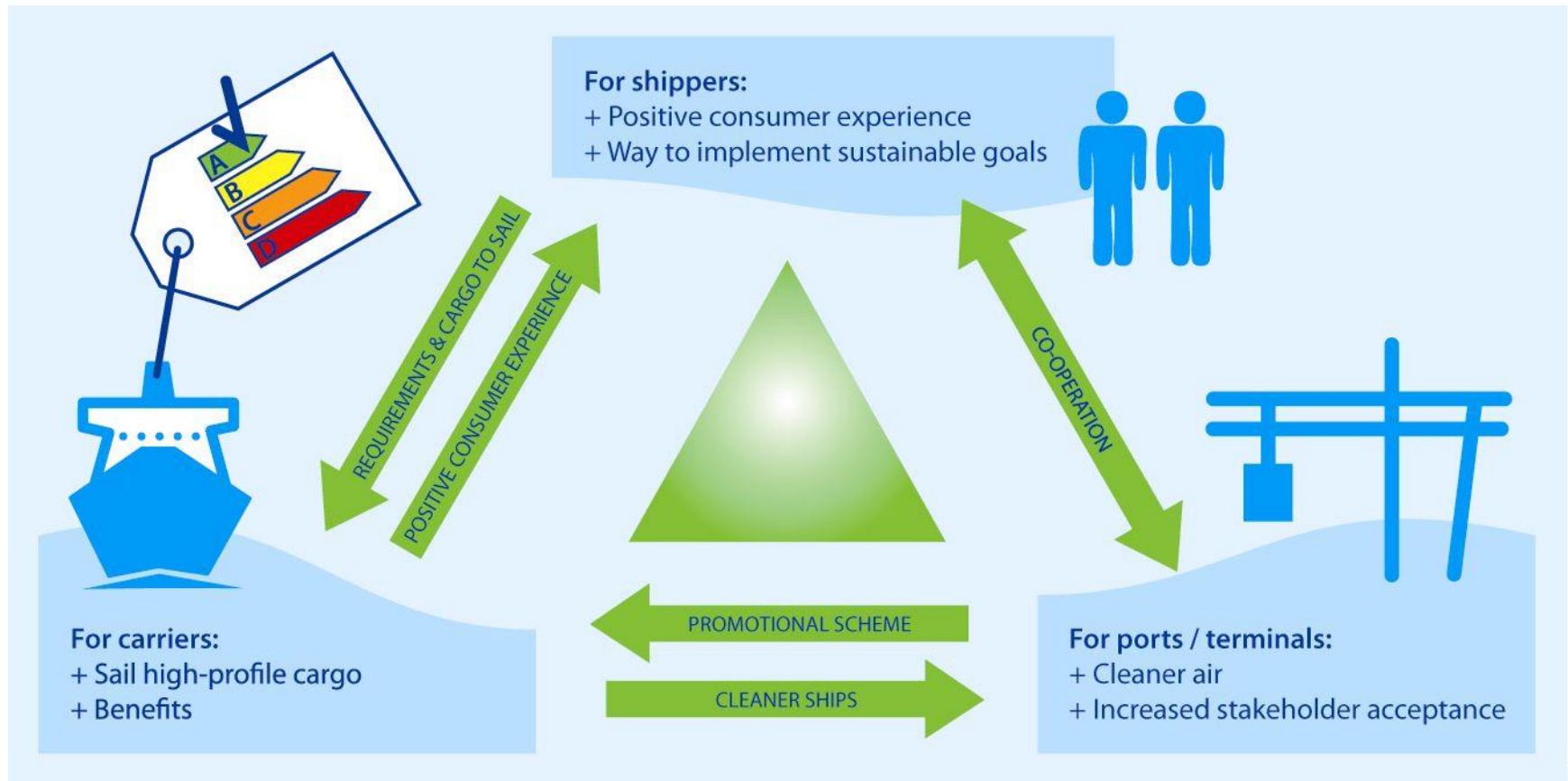
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1. ESI is a system operated by WPCI, in which we identify ships that perform better than usual ships in reducing gases emissions and ports give some incentives to these environmentally friendly ships.
2. It provides a tool that will assist ports and other parties to promote clean shipping.
3. ESI is composed of credits (0 – 100) for above-baseline environmental performance regarding NO<sub>x</sub>, SO<sub>x</sub>(indirect PM) and CO<sub>2</sub>
  - NO<sub>x</sub>: depending on performance of main- and auxiliary engines
  - SO<sub>x</sub>: depending of the sulphur content of the fuels used
  - CO<sub>2</sub>: bonus for monitoring and reporting of CO<sub>2</sub> emissions
4. Ports develop their own incentive schemes based on ESI points and inform the ESI administration



# Environmental Ship Index (ESI) (2)

## Benefit of each Party







## Environmental Ship Index (ESI) (3)

1. As of January 1<sup>st</sup>, 2016, a total of 3,809 ships of which 2,599 ships have scores over 20, and 43 incentive providers including 42 ports (Amsterdam, Rotterdam, Hamburg, Antwerp, Le Havre, Los Angeles, Busan, Tokyo and others) participate in the system.
2. Some examples of incentives are shown in the table below.

Incentive Provider	Minimum Requirements	Incentives
Port of Amsterdam	ESI score 20 or more	6% or more reduction on port dues
Port of Rotterdam	ESI score 30 or more	10% or more reduction on port dues
Port of Oslo	ESI score 20 or more	30% reduction on port dues (tankers only)
Port of Antwerp	ESI score 30 or more, or 25 best ships	10% or more reduction on port dues
Port of Hamburg	ESI score 20 or more	10% or more reduction on port dues
Los Angeles	ESI score 25 or more	Incentive grant (\$250 - \$1,250)/call based on ESI scores



# LNG fuelled Vessels

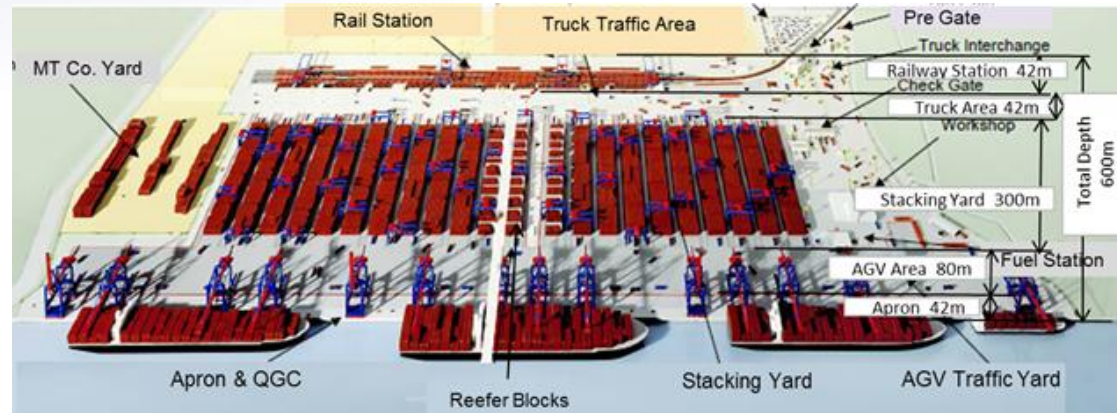
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1. Since ECA (Emission Control Area) was introduced by IMO, North America and North Europe have been keen to reduce local gases emission such as Sox, Nox and Particulates.
2. However, the prices of high quality oil (sulphur content: less than 0.1%) is quite expensive.
3. LNG (liquefied natural gas) is much a cleaner energy and less expensive source, which can almost eliminate sulphur emissions and particulates, reduce CO<sub>2</sub> and Nox by 26% and 80-90% respectively.
4. At the moment some seagoing vessels are already fueled by LNG (about 30 vessels in North Europe) and new engines are being developed by the manufacturers.
5. The challenges are future cost associated with LNG as vessel fuel, safety at ports and bunkering facility at ports.
6. IAPH made public a dedicated web-site last July, which is comprised of detailed safety checklists of LNG bunkering at ports (ships to ships, trucks to ships, tanks to ships, and so forth).



# Terminal Automation

1. Container terminal automation started in Europe in 2002, at the Ports of Hamburg and Rotterdam.
2. Automation systems have evolved since then to improve port efficiency, save labor costs and upgrade the port safety level.
3. At the moment, terminal automation has become the norm for large scale container terminals.
4. As modern automated terminals usually achieve high handling efficiency with electric or hybrid equipment, terminal automation is one of the tools to reduce gas emissions.





# Climate Change -Adaptation- 1

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## Climate Change Impacts on International Seaports

1. Questionnaire survey to IAPH member ports on how they plan to adapt to climate change was carried out in collaboration with AAPA (American Association of Port Authorities) and Stanford University.

## 2. Major Results

- they discuss more frequently mitigation than adaptation measures.
- most ports prepare port planning on a 5-10 year horizon.
- design standards of most ports cover 50-year or more historic flood (or storm) events (but not climate change).
- about a half ports do not address the climate change issue at this time.
- Sea Level Rise is the chief concern among ports, which is followed by storm impacts.
- 38% predicts SLR of 0.5-1.0m by 2100 and 15% 1.0m or more.
- 39% feel that 0.5-1.0m would be a problem and 58% that 1.0-2.0m would be a problem.
- ports should be better informed of local SLR and other climate events.





# Climate Change -Adaptation- 2

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## Seaports and Climate Change

### - An Analysis of Adaptation Measures-

-- Possible climate change impacts on different types of port facility are addressed.

-- Those types are:

1. access channel, vessel mooring area, breakwaters, shore-protection works and hinterland connections as basic infrastructure;
2. inner channel, revetments, quay walls, mooring buoys as operational infrastructure;
3. stacking yard, warehouses, silos, and offices as port superstructure;
4. ship and cargo handling equipment as port equipment

-- Opportunities and risks caused by possible climate change impacts such as sea level rise and weather intensification are addressed for each type of facility.

-- A good guidelines for adaptation measures in ports but lacks best practices.







# Conclusion

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- 1. In order to address gases emissions for each maritime operation, effective strategies should cover all the modes of transport such as ocean-going vessels, harbor crafts, cargo handling equipment, trucks, light vehicles, rail.**
- 2. IAPH issued several web-based guidelines and manuals to mitigate gases emissions from port activities, which are on its website.**
- 3. These include “calculation of gas emission levels of ports”, “development of port clean air programs”, “installation of on shore power supply system”, “introduction of environmental ship index”, and “safety checklist of LNG bunkering at ports”.**
- 4. Based on the port clean air programs, the Port of LA and LB have achieved remarkable outcomes in reducing gases emissions from the ports.**
- 5. Currently, 120 berths have on- shore-power supply systems in the world.**
- 6. Container terminal automation can also contribute to the reduction of GHG emissions with its high efficiency and clearer handling equipment.**
- 7. IAHP needs to work more on adaptation measures of global warming.**
- 8. IAPH’s future actions**
  - 1. to update the manuals and guidelines and make them more user friendly**
  - 2. to complete the outstanding projects (cargo handling equipment, etc.)**
  - 3. to urge port authorities to use these tools to mitigate climate change**
  - 4. to study on the adaptation measures by collecting good practices**