Executive Summary

This book discusses the drivers of port activities, reviews examples of the environmental impacts of port, and discusses the environmental and economic impacts of various policy instruments that are or can be applied to address these impacts. It draws in particular on findings from case studies of five of the largest ports in OECD countries, *Los Angeles* and *Long Beach* in United States, *Rotterdam* in the Netherlands, *Vancouver* in Canada and *Busan* in Korea, in addition to more *ad hoc* information regarding other ports.

Major findings

While well-functioning ports can play an important role in promoting economic development in the surrounding regions and a wider hinterland, this study has also clearly indicated that port activities can have significant negative impacts on the environment. Shipping has an environmental impact both in ports, as well as in the immediate vicinity of the ports. Examples of these impacts are noise from ship engines and machinery used for loading and unloading, exhausts of particles, CO_2, NO_x and SO_2 from the ship's main and auxiliary engines, and dust from the handling of substances such as grain, sand and coal. Road and rail traffic to and from the port area cause additional environmental problems. The environmental impact of ports may thus be divided into three sub-categories: *i)* problems caused by port activity itself; *ii)* problems caused at sea by ships calling at the port; and *iii)* emissions from inter-modal transport networks serving the port hinterland.

Due to the wide range of these impacts, a broad mix of policy instruments needs to be applied to managing environmental impacts, and the "optimal" mix of instruments is likely to vary much from port to port.

Indeed, authorities at various levels have put in place a wide range of instruments to limit negative environmental impacts, both in relation to *near-port shipping activities* as such (*e.g.* limits on the sulphur content of the fuels that may be used, and requirements regarding the treatment of ballast water), in relation to the *handling of the goods* in the ports (*e.g.* emission standards for the handling equipment, and limits on permitted noise levels), and in relation to the *transport of the goods to the hinterland* (*e.g.* emission standards for vehicles used in the transport, and investments in better road and rail infrastructure).

The *types of instruments* applied varies much – including "soft" instruments like information provision; investments in new road and port infrastructure; bans on certain activities (*e.g.* on the use of antifouling containing biocides); standards on input use (*e.g.* on sulphur contents in fuels), on technologies to be applied (*e.g.* double-hulls on tankers) and on emissions (*e.g.* regarding goods-handling equipment); and various sorts of economic incentives (*e.g.* differentiated port dues).

In many cases, economic instruments can provide more flexibility for polluters to find low-cost opportunities to reduce negative environmental impacts than what bans and standards do. As mentioned, a number of economic instruments are being applied to address negative environmental impacts of port – and the related shipping – activities. However, the economic instruments used in this sector are generally of a somewhat "prescriptive" nature and are unlikely to change the economic incentives that generate innovations to address the underlying environmental problems at a lower cost. One reason is the lack of a global framework for addressing environmental impacts of international shipping, making it difficult for individual countries to take action that would "internalise" the climate change impacts (*e.g.* by putting in place a carbon tax on bunkers). Another reason is the difficulties involved in monitoring and enforcing such actions (for example, a tax on the real SO_2, NO_x, or noise emissions from each ship).

The objective of this study was primarily to collect and compare experiences as regards environmental impacts stemming from port activities and to provide examples of policies used to address these impacts. It would also have been interesting to compare the costs and benefits of the related policy objectives, and analyse whether a given (environmental) outcome has been reached at the lowest possible cost to society. That has not been possible to do in this study. However, given the policies addressing international shipping activity at present, it is possible that almost *any* policy implemented to address the externalities caused by that sector *between the ports* would pass a cost-benefit test – if it could be reasonably well enforced. Opposed to this, regarding the *land-based sources* of environmental externalities stemming from port activities, a broad spectre of policies is already in place. The challenge for policy makers is to determine whether it is better to introduce stricter policies regarding these sources or, possibly, to address other priorities in society (environmental or otherwise – such as health, education, etc.).

While it is difficult to identify "best practices" for *all* the environmental impacts that port activities generate, introduction of shore-side electricity would have the advantage of reducing several negative impacts simultaneously, such as SO_2, NO_x and particle emissions, noise – and, possibly, CO_2 emissions. In countries where electricity generation is covered by a "cap-and-trade" system for CO_2 emissions (*e.g.* in the EU), the latter would be the case, regardless of how the electricity used to supply the ships is produced, as long as the "cap" remains unchanged. An important obstacle to a broader use of shore-side electricity is, however, that electricity systems vary between countries, both in terms of voltage and frequency. And it is not enough to make shore-side electricity available: unless ships are obliged to use it, they have few incentives to do so.

Exhaust emissions

Exhaust emissions are among the most pervasive of the environmental impacts of ports, and also some of the impacts that are most challenging to address. Most ships have several diesel engines, including auxiliary engines for onboard electricity production. Among ships with two-stroke, low-speed engines, 95% use heavy fuel oil (HFO) and the remaining 5% are powered by marine distillate oil. Around 70% of ships propelled by medium-speed engines use HFO, with the remainder burning either marine distillate oil or marine gas oil. Approximately 80% of the fuel consumed in international shipping consists of heavy fuel oil and most of the remaining 20% of marine distillate oil or marine gas oil.

Sulphur

The shipping sector use fuel grades that are no longer accepted in land-based installations or road vehicles. Distillate diesel fuel on average contains 0.3-0.5% sulphur and residual fuel oil generally 2.3-3.0%. The average sulphur content was 2.6% worldwide in 2009, or 26 000 ppm, which *e.g.* may be compared to a maximum of 10 ppm sulphur in diesel fuel allowed in European road vehicles from 2009.

There is a worldwide limit on the sulphur content in marine fuels of 4.5%. This "cap" will be reduced to 3.5% from 1 January 2012, then progressively to 0.5%, effective from 1 January 2020, subject to a feasibility review. In special "Emission Control Areas" (ECAs) designated by the IMO, the sulphur content must, since 1 July 2010, not exceed 1%, and this limit will be further reduced to 0.1 %, effective from 1 January 2015.

Nitrogen oxides

In the combustion of fuels, nitrogen in the atmosphere reacts with oxygen to form oxides of nitrogen (NO_x). NO_x emissions have residence times in the atmosphere of 1 to 3 days, which mean they can be transported up to 1 200 km. It is estimated that NO_x emissions from the shipping industry contributes from 10% to 15% of the global anthropogenic NO_x emissions from fossil fuels.

In 2008, the IMO adopted new emission standards for NO_x from *new* ship engines, with two steps. In the first step, emissions are to be cut by between 16 and 22% by 2011 compared to 2000, and in the second step, reaching 80% reduction by 2016. The longer-term limit will, however, only apply in specially designated areas. As regards *existing* ship engines, no significant reductions of NO_x emissions are expected.

Particles

The combustion of residual fuel gives rise to large emissions of particulate matter (PM). The finer fractions of these particles often stay airborne over long distances. It can take hours or days for PM_{10} (particles with an aerodynamic diameter of 10 micrometers) to settle on the ground or sea. Fine particles are strongly correlated with harmful effects on human health. Fine particles also have climate-forcing impacts, either contributing to, or offsetting, the effects of greenhouse gases. Black carbon particulate matter has been identified as an important contributor to radiative heating.

There are currently no emission limits for particulate matter for marine engines. However, low-sulphur fuels produce much less PM than heavy fuel oil.

Measures taken to address air emissions

Many port cities have ambient concentrations of NO_2 and PMthat exceed national or regional/federal standards or the recommendations by the WHO. Port authorities may thus find themselves under pressure to reduce exhaust emissions from ships' manoeuvring in ports and from their use of auxiliary engines at berth. This can in principle be achieved by three different measures: *i)* Improved fuel quality; *ii)* use of after-treatment technologies; and *iii)* use of shore-side electricity.

An example of the first type of measure is the EU Sulphur Directive that requires ships calling at European ports not to use fuel with more than 0.1% sulphur while at berth. This regulation also applies to any fuels used by inland vessels.

Sweden has introduced differentiated fairway and port dues based on the ships' emissions of SO_x and NO_x. Ships using bunker oils with low sulphur content qualify for discounts. Ferries that use fuels with less than 0.5% sulphur, and other ships using fuels with less than 1.0%, get a discount on fairway dues. Also, ports representing more than 90% of the traffic differentiate their dues according to the sulphur content of the fuel used. A number of ships have been certified for a NO_x-related discount of the Swedish fairway dues.

Allowing shore-side electricity to replace power and heat produced onboard by an auxiliary engine can reduce not only NO_x, SO_2 and particle emissions, but also noise. Whether shore-side electricity is a better option than use of environmentally benign fuels, perhaps in combination with after-treatment of exhaust fumes, depends largely on the time the ships spend at berth, the amount of power needed, and (often) the source of the shore electricity itself.

A problem in relation to use of shore-side electricity is the lack of an international standard for the plug-in systems. One challenge in this context is that different parts of the world have different voltages and frequencies in their electricity supply systems. The USA, Canada and Japan use 60 Hz, while most of the remaining world has electricity systems based on 50 Hz. However, systems that can handle any combination of 50 and 60 Hz power supplies are now available.

In response to major local air pollution problems in Southern California, state authorities and the ports of *Los Angeles* (POLA) and *Long Beach* (POLB) have implemented many measures to improve the situation. For example, by 2012, only trucks that comply with EPA emission standards for 2007 model year trucks will be allowed to haul cargo at these ports. The two ports are also levying a USD 35 per TEU container Clean Trucks Fee to provide local funding for financial incentives that help truck owners replace existing truck engines – in addition to funding from state sources.

Until June 2009, the two ports also provided financial incentives to vessel operators to use low-sulphur fuel in their main engines as they approached the ports. However, since the use of low-sulphur fuel within 24 miles of the Californian coast is now a state-wide requirement, the financial incentives have been discontinued. POLB has a *Green Flag Program* with reduced docking fees for vessels that comply with a voluntary speed limit of 12 knots in Southern California waters. Both ports have infrastructure for container and passenger vessels to plug-in to shore power.

The Port of *Rotterdam* Authority (PoRA) and an energy company have conducted a pilot shore-side electricity project in one of its inland shipping ports. As this pilot was successful, shore-side electricity will be made available to all berths for inland shipping in 2012. However, PoRA does not yet offer shore-side electricity to seagoing ships.

The PoRA has equipped some of its ships with particle filters and SCR catalysts that reduce emissions of NO_X with a chemical reaction into other less harmful substances. The PoRA is also promoting clean techniques for inland vessels in the port by pricing mechanisms and bans. The municipality of Rotterdam has decided that, from 2013 onwards, trucks that do not meet the EU Euro V-standard will be banned from much of the port area. From 2016, only Euro VI standard vehicles will be allowed.

Also in the case of *Vancouver* national authorities and port authorities have taken a range of measures to reduce air emissions from port activities. In addition to the establishment of a North American Emission Control Area – under IMO rules, and in co-operation with US authorities – and the introduction of increasingly strict national standards on sulphur contents in fuels, the port has, for example, introduced a differentiated harbour dues programme which provides incentives for ships to reduce emissions beyond legal requirements. In 2009, Port Metro Vancouver also launched a shore power facility at its cruise terminal.

The port is also gradually introducing stricter emission standards for cargo-handling equipment, rail locomotives, trucks, harbour vessels, etc. A "menu" of potential actions to meet the performance measures is also listed for each emission source group, as well as measurement and reporting criteria to track annual progress.

To respond an increasing demand for container cargo and to solve the traffic jam, air pollution and noise caused by container trailers, Korean authorities are developing a new container terminal in a non-residential area about 25 km to the west of *Busan* City. All the container cargoes there are handled in on-dock container yards, and there are dedicated railways and roads for transporting the containers. A number of eco-friendly technologies have been introduced in the new port, such as gantry cranes operated by electricity, shore-side electricity, renewable energy sources, etc.

The older Busan North Port is very limited geographically and there are not enough yards for container handling. Therefore, a number of off-dock container yards (ODCY) are operated for container handling before loading and after unloading. Previously, there was much traffic at the gate when container trucks arrived from an ODCY, resulting in air pollution and time-losses. However, the port authority has introduced a radio frequency identification system for container trucks to pass the gate to designated berths without delay.

Energy use and emissions of greenhouse gases

Most of the energy consumed by shipping is used for propulsion, of which a tiny fraction for manoeuvring in ports where vessels usually operate for a short moment and at low speed. The largest scope for improvement regarding energy use in shipping activities is thus in the voyage between ports. However, there are still a number of measures that ports can take to increase energy efficiency and reduce greenhouse gas emissions.

Measures addressing energy use and greenhouse gas emissions

A prime objective of ports is to "clean up in their own premises" in relation to energy consumption and carbon emissions. However, port authorities may have an additional role to play in providing port-state control for a possible future system to limit CO_2 emissions from international shipping.

Ports make use of buildings, including warehouses, and machinery, including vehicles owned by the port authority. Ports located in arctic and temperate climate zones may improve insulation and heat recovery in buildings, while ports in sub-tropical and tropical areas can choose efficient means for cooling and air-conditioning. Overall energy savings in the order of 30 to 40% might be achieved through various efficiency measures.

As an example beyond the case studies prepared especially for this report, the port of Seattle has implemented a number of measures to cut waiting times and reduce idling, among them computer tracking systems at cargo terminals to quickly locate containers, alert truck drivers to draw-bridge opening times, and newly-built overpasses and improved intersections for better traffic flow and reduced congestion.

Many ports are located in windy areas and an increasing number make use of these conditions to invest in wind-power. The ports of Amsterdam and Zeebrugge are homes to large wind turbine parks. Wind turbines have also been installed at the ports of, for example, Liverpool, Marseille, Gothenburg and Freemantle. Solar energy is increasingly used for powering navigation buoys and may also be used as a supplement to the production of fossil-based electricity in locations where solar radiation is relatively evenly distributed over the months of the year.

The Marine Environment Protection Committee of IMO has "recognized the need to develop an energy efficiency design index" for new ships in order to stimulate innovation and technical development in the design of ships.

The ports of *Los Angeles* and *Long Beach*, and their parent cities, are undertaking major efforts to address climate change. For example, in May 2007, the City of Los Angeles adopted *Green LA: An Action Plan to Fight Global Warming*, which directs the port to develop an individual Climate Action Plan to explore opportunities to reduce GHG emissions from municipal operations. Such a plan was presented in December 2007, and as part of that and its numerous GHG reduction measures, the POLA began reporting emissions inventories in 2008. Similar actions have been taking by POLB and both ports are following the adopted *San Pedro Bay Ports Clean Air Action Plan*.

Many Californian policies and regulations to reduce GHGs greatly affect the two ports. The most immediate and far-reaching measures are contained in the Scoping Plan under the *California Global Warming Solutions Act* of 2006. In some cases, the measures are meant to reduce both conventional air pollutants and GHG emissions. This includes a phase-in up to 2020 of a requirement for most container, passenger and refrigerated cargo ships to receive power from the electrical grid, and stricter emission standards for many sorts of equipment.

The port of *Rotterdam* is involved in the *Rotterdam Climate Initiative*, which joins together a number of important actors to try to limit the CO_2 emissions in the Rotterdam area, including those from port-related activities. The goal is a 50% CO_2 emission reduction by 2025, compared to the level in 1990. The port is, amongst other things, seeking to become a hub for capturing, transport and storage of carbon, and the most energy-efficient port and industrial cluster in the world.

Another initiative of the PoRA is a sustainability index for its own activities. The index covers a number of issues, with CO_2 as one of the most important. The PoRA has calculated its own CO_2 footprint, covering mobility, building energy consumption and energy management, including emissions from subcontractors. The footprint measures the direct CO_2 emissions (not the whole supply chain) from the activities of the port, and can be used as a tool to identify areas where emission reductions can be achieved.

Another way the PoRA uses its sustainability index is in its tendering processes. As the PoRA is the governing body of the port area, it can decide what type of organisations, and under what conditions, they will accept at the port. Through the use of sustainability conditions in tendering processes, the organisation promotes enhanced practices. For some sectors, energy use can play an important role in the tendering process.

Port Metro *Vancouver* is updating its annual corporate emissions inventory and developing a GHG reduction plan, including targets and metrics for ongoing measurement, to provide information needed to make appropriate environmental management decisions, and so that it may be ready for future reporting requirements. The *Air Action Program* includes initiatives being undertaken by the Port, terminal operators, other industries and regulatory agencies, which all help to reduce port-related air emissions. Port Metro Vancouver has established air emission baselines and maintains databases for specific port sites. Furthermore, as the Official Supplier of Port Service to the Vancouver 2010 Olympic and Paralympic Winter Games, Port Metro Vancouver partnered with VANOC and Offsetters to voluntarily offset carbon emissions created by the Games-time activities. By offsetting all of the port's operations during the Vancouver 2010 Winter Games, the port was able to contribute to a carbon-neutral Games.

As regards *Busan*, in February 2009, a *Presidential Committee on Green Growth* was established to implement the national project of "Low-Carbon, Green Growth", presented as a national vision by President Myeong-Bak Lee in August 2008. In July 2009, this committee finalised a *Five-Year National Plan for Green Growth*. Based on this, all the relevant ministries are establishing action plans, and already in 2008, the Ministry of Land, Transport and Maritime Affairs established a plan that *i.a.* focused on fuel oil efficiency and reduction of CO_2 emissions from ships.

Noise

Noise in port areas is caused by many sources, for example by ship engines, fans, cranes, tractors and trucks. The extent to which noise from harbour activities is perceived as a nuisance depends on the sound pressure and frequency, the distance to local communities, etc.

Measures addressing noise in ports

Citywide noise "ordinances" are imposed by the cities of *Los Angeles* and *Long Beach*. They limit noise-producing activities to 7:00-21:00 on most days, and prohibit them altogether on Sundays and national holidays. Maximum ambient noise levels are capped for residential, hospital and school zones at all times.

The Rijnmond area is divided into several zones that have been granted an average specific sound emission per m^2 for industry noise. The *Rotterdam* Port Authority is free to differentiate the noise emission levels in contracts with its clients, as long as the average level is maintained. As the permitted sound level is stricter during the night, the standards present an obstacle to 24 hour operations in some locations. The interdiction for barges to use their auxiliary engines at locations where electrical power outlets are available helps limiting noise generation. This policy will be expanded to all berths for inland barges in the next years.

The City of Vancouver administers a Noise Control Bylaw that establishes limits of noise levels for weekdays and weekends. Port Metro Vancouver has identified noise as a corporate social responsibility issue and is developing a noise and nuisance management and monitoring plan and is proactively pursuing solutions to existing noise issues.

The electrification of rubber-tired gantry cranes in *Busan* is expected to significantly reduce noise levels.

Ballast water

Ships use ballast water to control draught and centre of gravity in order to insure stability at sea. Ballast water acquired in one region may contain invasive aquatic species which, when discharged in another part of the world, may thrive in a new environment and disrupt the balance of the marine ecosystem.

Measures addressing ballast water

In 2004, the IMO adopted the *International Convention for the Control and Management of Ships' Ballast Water and Sediments*, according to which the Parties shall adopt stringent measures to prevent, reduce and eliminate the transfer of harmful aquatic organisms and pathogens from ships' ballast water and sediments. However, this convention is not yet in force, as not enough countries have ratified it. However, individual countries are nevertheless moving ahead with measures to address the adverse environmental effects of ballast water as the impacts are locally often very significant.

In December 2008, the US EPA established a system of Vessel General Permits (VGP). The VGP will affect nearly 100 000 vessels using US ports, including the ports of *Los Angeles* and *Long Beach*. The EPA has approved California's certification, thereby providing for full implementation of the VGP in the State. The VGP establishes effluent limits for many discharge streams, covering aquatic nuisance species in ballast waters, substances typically found in wastewater, metals, nutrients, pathogens and toxic pollutants.

California's approach to managing ballast water and reducing the introduction of non-indigenous species consists of *ballast exchange requirements* in coastal waters, and *ballast water discharge requirements* that phase in between 2009 and 2020. California has two ballast water exchange requirements; one that applies to vessels travelling within the Pacific Coast Region, and another for all other vessels. The ballast water discharge requirements begin with interim requirements that ballast water be treated or disinfected so that it meets specific biological requirements. These requirements limit the numbers of organisms per water volume. The final regulations, which will become effective after 2020, require that ballast water discharged contain *no* (zero) detectable, living organisms.

The Netherlands signed the IMO Ballast Water Convention in 2005. The port of *Rotterdam* has not set any additional measures to control ballast water discharges.

Canada ratified the IMO Ballast Water Convention in 2010 and is proceeding with regulations under the *Canada Shipping Act, 2001*. Transport Canada operates the *Canadian Ballast Water Program* in response to significant national concern with the introduction of alien invasive species by international shipping – in *Vancouver* and other Canadian ports. The programme has a mandatory ballast management requirement with four allowed options for ship ballast: Exchange at sea; retain onboard; pump ashore to treatment; or use on-board treatment.

Transport Canada currently has an enforcement programme at the national level. Ship inspections occur for approximately 25% of ships arriving to coastal ports and include record checks as well as sampling of ballast for salinity to verify that the water had been exchanged at sea.

The *Canada Marine Act* provides port authorities with the ability to monitor ships about to enter a port and establish practices and procedures to be followed. This includes management of safety and efficiency and environmental protection. Port Metro Vancouver has defined local practices to protect the marine environment. This gives the Harbour Patrol a mandate to board ocean-going vessels within the port's jurisdiction to communicate the port's environmental policies.

Sewage, sludge and oil spills

Sewage and wastewater are generated onboard all ships, sometimes in large quantities. Discharges of these wastes into port waters may include organic, biological, chemical and toxic pollutants.

Measures addressing sewage, sludge and oil spills

Deliberate discharge of oily machine room water remains a problem many places, despite IMO's guidelines for the prevention of pollution by oil. A control revealed that 90% of the ships calling at Gothenburg did not have well-functioning oil separation systems.

Large accidental oil and chemical spills may occur as a result of collisions involving tankers, the largest of which can carry several hundred tonnes of crude oil. New tankers are now to have double hulls or alternative designs having similar properties. Ports in several parts of the world have differentiated port fees to stimulate early introduction of double hulls. In Finland, the *Oil damage levy* has 50% lower rates for ships with double hulls compared to other ships.

The port of Stockholm operates treatment plants at its ferry terminals, in order to prevent toilet and kitchen wastewater from being rejected into the sensitive brackish water system of the Baltic Sea. A 2004 agreement between the port of Seattle, the Washington State Department of Ecology and the Northwest Cruise Ship Association prohibits all untreated cruise ship wastewater discharges.

Regarding the ports of *Los Angeles* and *Long Beach*, California has sought to impose stringent liquid wastes discharge limits on ocean-going vessels. Except for sewage, state law prohibits liquid waste discharges in California coastal waters unless vessels are unable to either store or offload wastes. Federal law prohibits discharging untreated sewage into US waters and California is working with federal authorities to create no discharge zones in which all sewage discharges would be prohibited.

Waste reception facilities have been installed by the port of *Rotterdam*, to facilitate and promote safe and environmental friendly disposing of waste products. It is obligatory for ships to discard their waste products at the designated waste reception facilities. To make sure the ships hand in their effluents, all ships have to notify the port on the waste on board and their capacity for waste storage.

For visiting ships, the Harbour Patrol of Port Metro *Vancouver* seals the engine room bilge discharge valve(s) with a tamper-proof seal. Any accidental discharges must be reported to the port immediately. One Harbour Patrol craft has thermal imaging that can be used to identify oil in water.

The *Busan* coastal area is biologically very productive, but the risk of oil spills from vessels is high because of the dense vessel traffic. Therefore, the Korean Coast Guard has established a regional contingency plan of the area and secured resources for effective oil spill responses.

Garbage

Routine operations of crew and passengers create solid wastes from activities such as food preparation and ship operations, and from cargo-related activities, such as spillage and disposal of packing materials. These wastes may include organic, biological, chemical and toxic pollutants that should not be disposed in port waters.

Measures addressing garbage

Many ports have well-designed systems for the reception of ship waste, where debris is integrated into the local or regional system for recovery and recycling. Examples of this can be found in the ports of Portland, New York and New Jersey, as well as in Stockholm and Gothenburg.

The port of *Long Beach* has a comprehensive recycling and solid waste management programme.

To facilitate and promote safe and environmental friendly disposing of waste products, waste reception facilities have been installed by the *Rotterdam* Port Authority. It is obligatory for ships to discard their waste products at the designated facilities. Ships are obliged to pay a fee for waste disposal, whether or not they use these facilities. The fees vary with the engine size. In exchange, the ship is allowed to dispose some garbage free of charge. If more garbage is handed in, the ship owner will be will charged for the additional costs.

Port Metro *Vancouver* does not permit any discharge of problematic garbage to the marine environment and discourages non-problematic discharges. Local suppliers are available to receive discharges from ocean-going vessels, for limited volumes.

Port reception facilities for garbage have been installed by private companies in the ports of *Busan* and Incheon. Such facilities have been installed by the Korea Organization of Environment Management in small ports in Korea.

Hinterland distribution and feeder traffic

The environmental impact of hinterland distribution of goods is affected by the efficiency of the transport chain, the choice of mode and the standard of the fuels and vehicles used. Generally, transport by rail, in-land waterways and short-sea shipping require less energy per tonne transported than transport by road, and cause fewer emissions of greenhouse gases. However, where emissions of NO_x, SO_x and PMare concerned, the choice of fuel and exhaust-treatment systems may be more important.

Measures addressing hinterland distribution and feeder traffic

The ports of *Los Angeles* and *Long Beach* engage in three types of rail loading: 1) on-dock rail yards that load cargo onto trains in the marine terminal, thus eliminating any truck trips on local roadways, 2) near-dock rail yards that are within five miles of the terminal and can serve both ports, and 3) off-dock rail yards, usually located 25-50 miles from the terminal, such as in downtown Los Angeles. To accommodate future growth of the ports, two new on-dock and two near-dock rail facilities are planned.

A major project for reducing rail transport congestion was the creation of the *Alameda Corridor* that opened in 2002, with a below-ground, triple-tracked rail line that is 10 miles long. Total cost was USD 2.4 billion. The corridor has reduced air pollution from idling cars and trucks, cut travel time, and reduced NO_x and PM_{10} emissions significantly. A follow-up Alameda Corridor East line is under construction. This will connect the ports to the transcontinental rail network and greatly improve distribution of cargo, and provide further emission reductions.

To reduce the levels of congestion of the truck routes to and from the port, and to increase the energy-efficiency of its operations, the port of *Rotterdam* has set the goal to ship more goods over water and railways, and less by the road. For 2030, the objective is to ship 35% by road, 45% by inland barges and 20% by rail. To be able to create a big modal shift, the PoRA has made binding agreements with container terminals at the *Maasvlakte 2* area for such a split. PoRA also tries to create a modal shift in the existing port areas, but their influence here is limited. One can, for example, not expect a modal shift from road to rail or inland shipping if there is no access to these modes.

The PoRA is also promoting the use of inland shipping by creating more loading capacity for inland barges; limiting the increase of port dues for inland barges; and optimises the service to inland barges. The situation of rail transport has also been improved with the completion a dedicated link for electric rail cargo transport to Germany.

Port Metro Vancouver is an important player in the development of the Pacific Gateway. The Pacific Gateway is a multimodal network of transportation infrastructure in Western Canada focused on trade with Asia. Through the Asia-Pacific Gateway and Corridor Initiative, the federal government has partnered with the private sector to invest in transportation infrastructure and technology, which will relieve traffic congestion and reduce air emissions.The *Busan* New Port is designed to carry container cargoes by dedicated railways and roads situated in the suburb of the City, thus limiting traffic jams, air pollution and noise. A new road connecting the old and new port, avoiding the City centre, will be completed in 2011.

From:

Environmental Impacts of International Shipping

The Role of Ports

Access the complete publication at:

https://doi.org/10.1787/9789264097339-en

Please cite this chapter as:

Braathen, Nils Axel (ed.) (2011), “Executive Summary”, in *Environmental Impacts of International Shipping: The Role of Ports*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/9789264097339-4-en

OECD