Port of Taichung

Environmental Report

▸2015

Port of Taichung

Taiwan International Ports Corporation, Ltd.

Port of Taichung
Environmental Report

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This environmental report presents Taichung Port's achievements in environmental protection from 2013 to 2014 as well as the environmental policy, commitments and action plans of the Port of Taichung, Taiwan International Ports Corporation.

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Taiwan International Ports Corporation Environmental Policy

"Leverage innovation effectively to connect and communicate with global trade flows. Mature into a world-class port management group" is the vision of Taiwan International Ports Corporation (TIPC). TIPC manages and operates commercial ports in Taiwan and is engaged in maritime transport related services, free trade zones, and the development of relevant tourism and recreational projects.

While TIPC pursues business growth, we are well-aware of the importance of our social responsibility, which is to ensure both environmental and economic sustainability. With the goal to establish green and sustainable ports, we will proactively identify environmental risks that may be associated with our activities and manage the risks accordingly to minimize the environmental impacts.

We commit to:

1. Implement and follow through with the Green Port Programme to establish extraordinary world-class ports;
2. Comply with applicable environmental regulations to fulfill corporate environmental responsibility;
3. Execute pollution prevention, monitoring, and control mechanism to enhance environmental quality in and around port areas;
4. Reinforce environmental education to cultivate environmental awareness among employees; and
5. Strengthen the communication with local communities, and pursue sustainable development for both the ports and the cities where we are operating.

Chih Ching Chang

Chang, Chih-Ching
Chairman of TIPC
Date: 10/14/2014

Lee Tai Hsin

Lee, Tai-Hsin
President of TIPC
Date: 10/14/2014

Environmental Policy of the Port of Taichung

Taichung Branch of TIPC understands our roles as a port management entity that is responsible for maintaining and improving the environment of the Port, and regards environmental protection as a part of port management. Therefore, we commits to mitigating the impact of port operation on the environment and aims to build an environmentally-friendly, sustainable and advanced high-quality port. In order to keep the port environmental performances consistent with the policy, the following principles will be put into practice:

Abide by environmental regulations and maintain the environment of the port;
Realize environmental monitoring and control sources of pollution;
Innovate pollution prevention technology and attain the status of a green port;
Head toward autonomous management and achieve sustainable development.

To achieve our promise in the environmental policy statement, the following environmental objects are set based on the ten major environmental impacts from the port:

- **Improve air quality in the port**
  Promote the deceleration of vessels, fuel change-over and the establishment of shore-based electric facilities; implement autonomous management of emission reduction of greenhouse gases and other air pollutants.
- **Develop a friendly land environment in the port**
  Develop a low-carbon, low-pollution and beautified green port, and carry out plans for landscaping and forestation in the port. Reduce fugitive dust emissions in the port: Encourage closed operation of stevedoring and warehousing; managing vehicles and machinery.
- **Prevent vessels from discharging sewage**
  Control garbage, waste oil and sewage management of vessels; carry out regular joint inspection and audit.
- **Improve water quality in the port**
  Monitor water quality in the port; reinforce inspection of, and report against, marine pollution.
- **Enhance the management of the dredging process**
  Investigate sediment pollution in the port; monitor the dredging process in the port and ensure its compliance with regulations.
- **Mitigate upstream pollution**
  Work with local governments to mitigate upstream pollution; optimize waterfront space in the port.
- **Reinforce the management of hazardous cargos in the port**
  Realize the management of hazardous areas; enhance the communication and coordination mechanisms for emergency responses.
- **Promote waste reduction in the port**
  Promote waste reduction and resource recycling; use dredged mud in land reclamation.
- **Mitigate soil pollution in the port**
  Continue to monitor and control polluted sites in the port; verify port industry are follow the regulation standard of soil and groundwater.

The President, Taichung Branch of TIPC is responsible for the implementation, maintenance, and communication and exchange of the environmental policy. The President is also responsible for reviewing the environmental policy every year, so as to comply with the commitments, and continue to improve and achieve the environmental objectives. The environment policy will be effectively conveyed to the staff, shipping companies, lessees and residents, and is available on the website of the Taichung Branch of TIPC.

TIPC 臺灣港務股份有限公司 TAIWAN INTERNATIONAL PORTS CORP.,LTD 臺中港務分公司 PORT OF TAICHUNG

Ying-Fong Chang

President of Taichung Branch of TIPC

Date: 2017/07/15

Message from TIPC

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Message from the Chairman of Taiwan International Ports Corporation, Ltd.

In the past few years, competition has been increasing in the global marine transportation industry, gradually driving the industry from a profit- and efficiency-oriented structure toward a future that creates multiple values. A port's success is typically the result of a considerable amount of support and unseen effort. The ultimate goal is to become an international port with modern infrastructure, high traffic, and friendly work environment.

Taiwan International Ports Corporation (TIPC) strives to become the most efficient port operating company and a more prominent member of the global marine transportation industry. While the core values of the company are innovation, globalization, and international excellence, TIPC continues to innovate and increase its competitiveness in planning, constructing, and operating its international ports. What remains unchanged is the company's commitment to protecting the environment, providing high-quality service, and improving living conditions in Taiwan. These core values, we believe, are essential to excelling in this generation.

TIPC has short-, mid-, and long-term goals of promoting green ports throughout Taiwan from the perspectives of tourism, cargo operation, port environment, and city and community development. In addition to enhancing the quality of tourism and the efficiency of cargo shipping, we aim to improve port environments and infrastructure to contribute to local city development. The company has also established communication channels with local governments and residents. We believe that guidance from the European Sea Ports Organization regarding EcoPorts would facilitate developing a more comprehensive port environmental management system and monitoring the effectiveness of TIPC's environmental management plan.

Chang, Chih-Ching

Chairman
Taiwan International Ports Corporation, Ltd.

Message from the President of Taiwan International Ports Corporation, Ltd.

To achieve sustainable development, socioeconomic advancement and environmental improvement must be considered. Accordingly, Taiwan International Ports Corporation (TIPC) has implemented environmental protection policies as a principle of port environmental management. While recognizing the environmental risks involved in port services and activities, the company is actively developing an autonomous port environmental management system.

With EcoPort and GreenPort becoming a trend in the global marine transportation industry, TIPC has been working on equipment upgrading, pollution control and green incentive program, as well as actively participating in port environmental management certification system. As a result, the Port of Kaohsiung became the first port in Asia to receive EcoPort certification in 2014, and we expect that the Port of Taichung and Port of Keelung will also obtain EcoPort certification this year.

As a transportation hub in the Pan Pacific area, Taiwan plays a critical role in promoting the development of international trade and marine transportation. By committing to developing green ports, the company has upgraded its equipment to enhance its competitiveness and implemented environmental protection measures to mitigate the environmental impact of port operations. We are committed to developing Taiwan's ports into first-class international ports while fulfilling our corporate social responsibility.

Lee, Tai-Hsin
President
Taiwan International Ports Corporation, Ltd.

Message from the President of Port of Taichung, Taiwan International Ports Corporation, Ltd.

Port of Taichung, TIPC is one of the international commercial ports in Taiwan, and annual container and cargo throughput have grown significantly since the completion of the port. The port was already handling millions of tons of cargo annually by 2000. But because of the port's rapid growth, the types and quantities of pollution have increased over the years. In order to protect the environment while developing economy, the Port of Taichung, TIPC has adopted a prospective development model that complies with the needs of sustainability, modern economics, and environmental protection.

The Port of Taichung, TIPC is currently involved in development and construction of a quality green port, which will transform Taichung Port into a green port that is environmental-friendly and low-polluting, as well as a port that recycles resources. In 1996, a professional organization implemented the project "investigation, monitoring and analysis of the Taichung Port environment" in order to gain a better understanding of the environmental quality and pollutant characteristics at Taichung Port, and ultimately build an environmental database and seek ways to prevent pollution.

In the future, the Port of Taichung, TIPC will be assessed by the European Sea Ports Organization (ESPO) with the goal of acquiring EcoPorts Certification and becoming one of the EcoPorts in the Pan Pacific Area. This will not only enhance the global competitiveness and image of Taichung Port, but also further Taichung Port's sustainable development.

Chung, Ying-Chung
President of Port of Taichung
Taiwan International Ports Corporation, Ltd.

Port Profile

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Port Profile

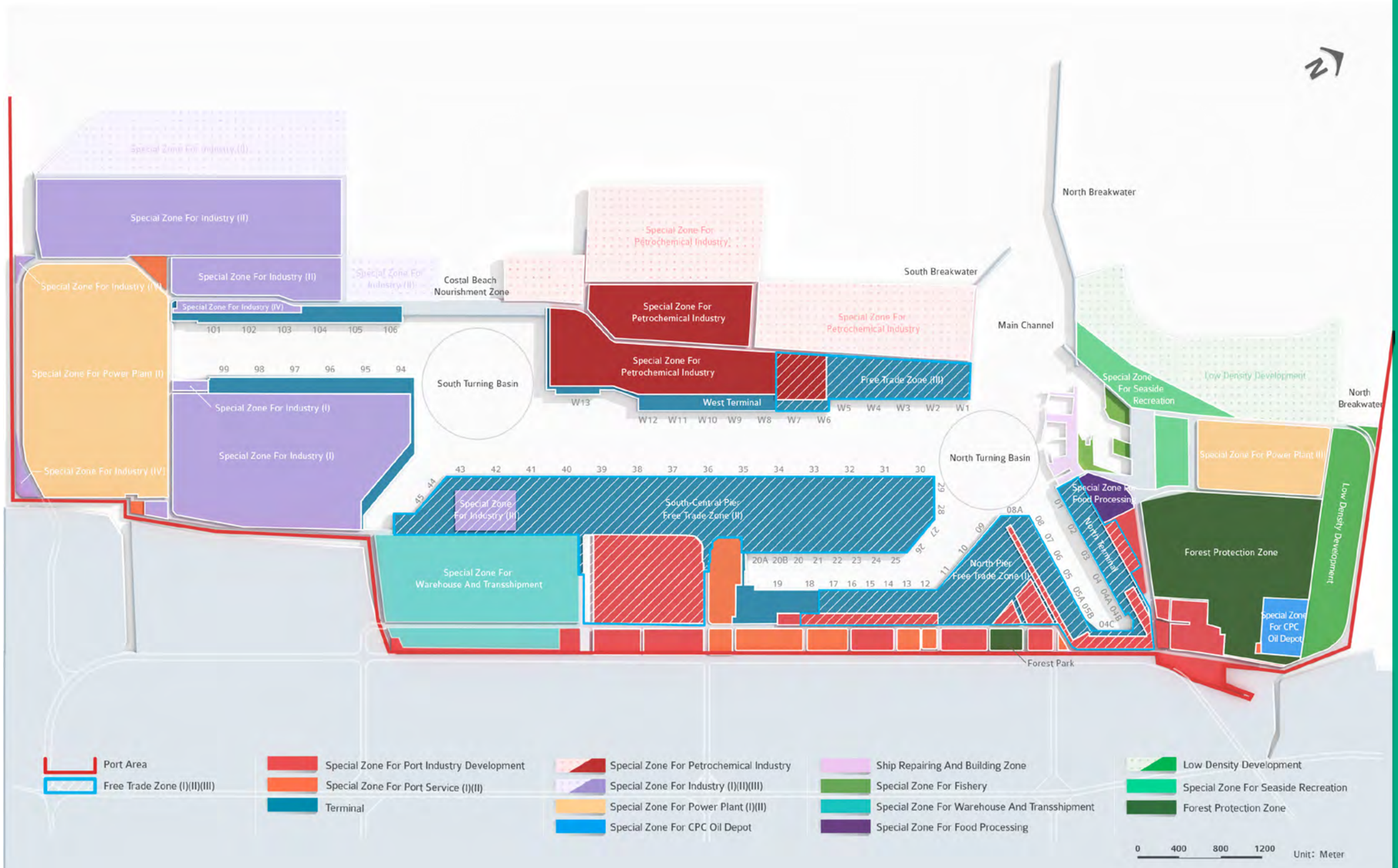
Port Location and Port Area

The Port of Taichung is located on the west coast of Taiwan (120°29′27.3″ and 20°17′40.3″ north latitude), and is a hub where the Taiwan Strait and the Bashi Channel rendezvous. In the north, the port starts at the southern shore of the Dajia River and to the south the port ends at the north shore of the Dadu River. The port is bordered by Lingang Road to the east. Overall, the port is 12.5 kilometer long from north to south and 2.5 to 4.5 kilometer wide from east to west. The port's total area is approximately 4,438 hectare (land area account for 3,480 hectare and marine area accounts for 958 hectare). The port has one entrance.

The Port of Taichung is the first man-made port completed by Taiwan and has an average tidal range of approximately 3.63 meter. The mouth of the port has high volume of silt and the marine area and seashore is mainly composed of intertidal beach, seawall, and beaches. The port is in proximity to neighboring industrial areas (Taichung Export Processing Zone), the Gaomei Wetland Preservation Area, protection forests, and agricultural lands. Four-hole rain box culvert, Eight-hole rain box culvert, and Wuqi drainage channel mouths is also in the area.

Legal Status and Port Operators

To promote modernized commercial port management system reforms, Taiwan amended the Commercial Port Law on December 28, 2011. In March 2012 the maritime system changed to a "separation of government and corporation" method. Previously publicly managed organization was transformed into state enterprise organizations, which combined port operation originally under Taichung Harbor Bureau, Kaohsiung Harbor Bureau, Keelung Harbor Bureau, and Hualien Harbor Bureau into a company managed system (Taiwan International Ports Corporation). This solved previous problem of commercial ports being limited by legal and system restrictions, which caused an inability to respond to market changes and decreased competitive strength. After restructuring of the Taichung Harbor Bureau, stevedore operation business is now the responsibility of the Port of Taichung, TIPC. Maritime administration, operation items, and public authority within the harbor are handled by the Central Maritime Affairs Center of the Maritime and Port Bureau (MPB).



» Taichung Port Master Plan

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Main Commercial Activities and Cargo Handling

Taichung port currently has 54 piers, including container, passenger and freight, and bulk cargo piers. The port mainly takes in bulk cargo and cargo categories include cement, coal, chemicals, and grains. Shipping routes are mainly between the two straits, and is the Taiwan international commercial port with the highest concentration of cross-strait shipping. Commercial activities within the port include petroleum processing, ferry terminal, recreation and leisure, chemical works, general manufacturing, storage and packaging, and refrigeration.

» Main Commercial Activities and Cargo Handling in Port of Taichung.

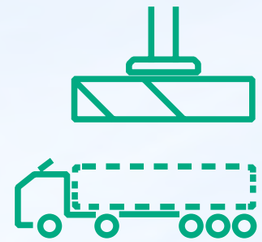
Commercial activities	
Aggregates (sand and gravel)	Petroleum processing
Ferry terminal/recreation	Chemical processing
General manufacturing	Storage and packaging
Refrigeration Container	
Cargo handling	
Dry bulk cargo	Liquid bulk cargo (non-petroleum)
Automobile	Petroleum
General cargo	

» Taichung Port business statistics from 2013 to 2014

Business item		2013	2014	Comparison between 2013 and 2014	
				Actual number	%
Incoming and outgoing ships	Total number of ships (vessel)	15,795	14,997	-798	-5.05%
	Total tonnage (ton)	239,650,722	243,250,829	3,600,107	1.50%
Cargo handling quantity	Container cargo (shipping ton)	52,833,780	54,495,324	1,661,544	3.14%
	Bulk cargo (shipping ton)	49,039,685	51,769,507	2,729,822	5.57%
	Channel cargo (shipping ton)	18,635,342	16,355,272	-2,280,070	-12.24%
	Total (shipping ton)	120,508,807	122,620,103	2,111,296	1.75%
Container handling quantity	Inbound container (TEU)	724,463	741,223	16,760	2.31%
	Outbound container (TEU)	743,142	772,536	29,394	3.96%
	Total (TEU)	1,467,605	1,513,759	46,154	3.14%
Cargo throughput	Imported cargo (metric ton)	58,058,466	59,720,215	16,61,749	2.86%
	Exported cargo (metric ton)	6,872,024	7,250,508	378,484	5.51%
	Domestic cargo (metric ton)	5,153,633	5,334,599	180,966	3.51%
	Total (metric ton)	70,084,123	72,305,322	2,221,199	3.17%
Number of travelers in and out of the port	Number of domestic line travelers (number of people)	9,635	9,263	-372	-3.86%
	Number of international line travelers (number of people)	162,916	154,839	-8,077	-4.96%
	Total number of travelers (number of people)	172,551	164,102	-8,449	-4.90%

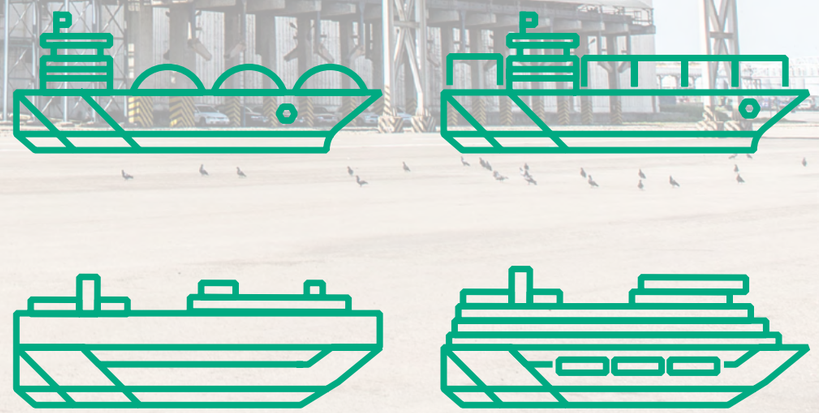
Main Cargo

The primary import cargo at Port of Taichung in 2013 and 2014 was mineral products, followed by plant products, and chemical or industrial products. Primary export cargo was base metal products, plastic and rubber products, and chemical and industrial products.



» Main Cargoes at Taichung Port.

Petroleum	Pyrites minerals
Crude oil LNG (liquefied natural gas)	Cement Phosphates Sulphur
Dry bulk	**Liquid bulk （non-oil）**
Chemicals Grains Scrapiron Timber Soya	Liquefied gases
Ores	**Other**
Coal	Cars/Vehicles Fish Fruit



Environmental Management System

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Environmental Management

Organization Structure

In addition to the Port of Taichung, TIPC environmental issues within the Port of Taichung also involves the Maritime and Port Bureau Central Maritime Affairs Center (Ministry of Transportation and Communications), the Bureau of Environmental Protection (Taichung City Government), the Environmental Protection Administration (Executive Yuan), the Coast Patrol Corps 3 and Offshore Flotilla 3 (Taichung) of the Central Coastal Patrol Office (Coast Guard Administration, Executive Yuan), the Taichung Harbor Police Department (National Police Agency, Ministry of the Interior), the Taichung Harbor Fire Brigade (National Fire Agency, Ministry of the Interior), the Taichung Export Processing Zone (Export Processing Zone Administration, Ministry of Economic Affairs), the Taichung Customs (Customs Administration, Ministry of Finance), and the Centers for Disease Control Central Area Control Center – Taichung Harbor Office.

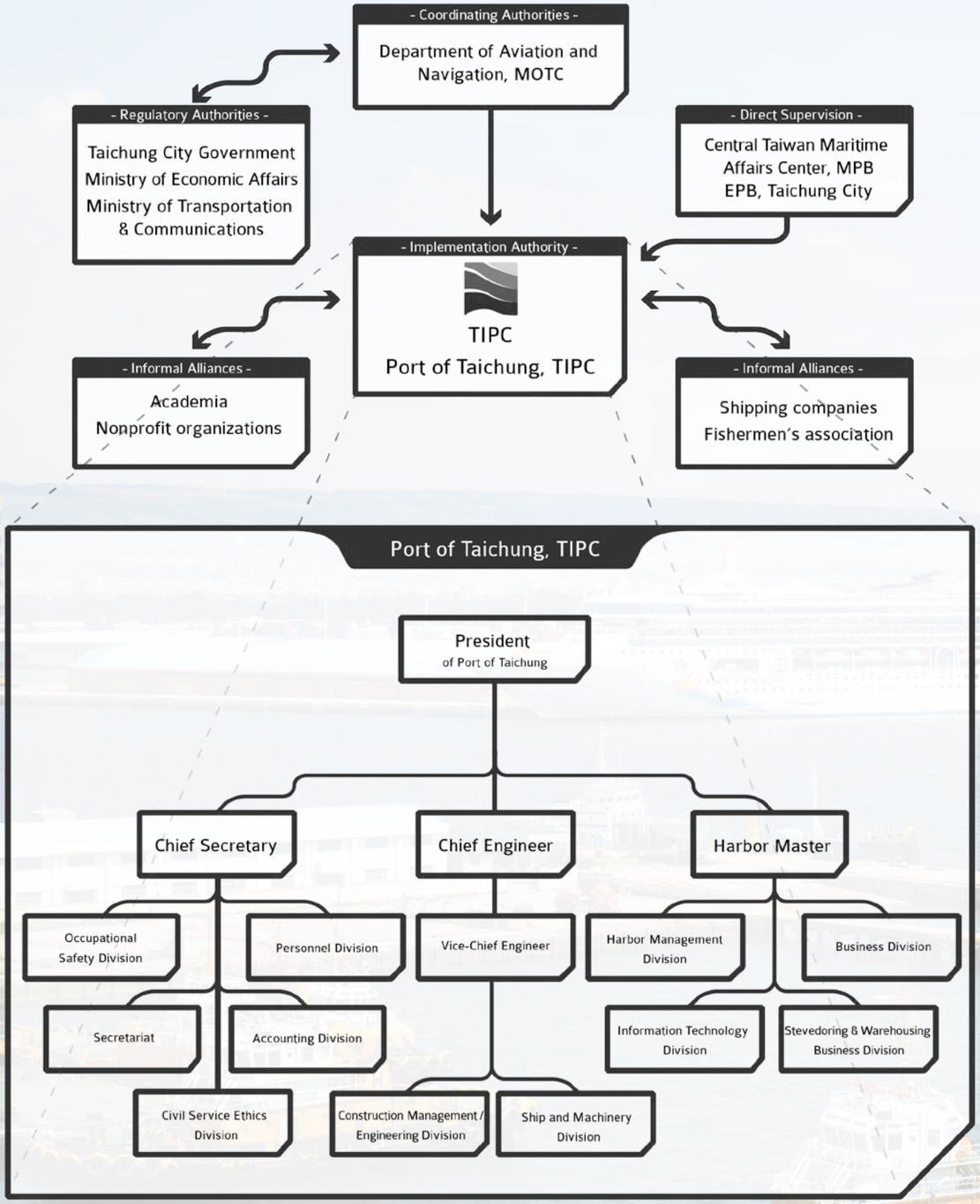
According to Commercial Port Law regulations, the Port of Taichung, TIPC and the Central Maritime Affairs Center (Maritime and Port Bureau, Ministry of Transportation and Communications) is responsible for environmental management in the Port of Taichung commercial port area. Port of Taichung, TIPC is responsible for environmental issues in management and operations while the Central Maritime Affairs Center shall handle environmental issues that involve public authority. Environmental Protection Administration (Executive Yuan), the Taichung Export Processing Zone (Export Processing Zone Administration, Ministry of Economic Affairs), and the Bureau of Environmental Protection (Taichung City Government) shall manage stevedoring and neighboring municipal areas, and monitor and supervise the environment. The Central Coastal Patrol Office of the Coast Guard Administration (Executive Yuan), the Taichung Harbor Police Department (National Police Agency, Ministry of the Interior), the Taichung Harbor Fire Brigade (National Fire Agency, Ministry of the Interior), and the Centers for Disease Control Central Area Control Center – Taichung Harbor Office shall assist with the monitoring of harbor area environment, implement bans, gather evidence, and prosecution.

The 11 divisions of the Port of Taichung, Taiwan International Ports Corporation consist of the Occupational Safety Division, Secretariat, Construction Management/Engineering Division, Harbor Management Division, Stevedoring and Warehousing Business Division, Port Business Division, Accounting Division, Information Technology Division, Personnel Division, Ship and Machinery Division, and Civil Service Ethics Division.

The Occupational Safety Division is mainly responsible for the environment of the harbor area, and the division is further divided into the Environmental Management Section and the Occupational Safety and Health Section. The Environmental Management Section handles harbor pollution prevention, environmental protection regulations, environmental impact assessment, environmental monitoring, handling of emergency events, environmental education, ecological preservation, planting and conservations, waste processing, and resource recycling. The Occupational Safety and Health Section handles labor safety and health business. Overall, 26 personnel are involved in environmental protection work.

» Functions of the divisions of the Port of Taichung, TIPC.

Division	Description
Occupational Safety Division	Port environmental protection, pollution prevention and management of occupational health and safety
Secretariat	Company Management
Construction Management / Engineering Division	Port planning, design, construction and supervision
Harbor Management Division	Port safety management and port affairs operation
Stevedoring and Warehousing Business Division	Tourist services and private store operation
Port Business Division	Attraction of local investment, implementation of port functions, and creation of benefit
Accounting Division	Budget review and management of income and expenditures
Information Technology Division	Development and maintenance of IT systems and equipment
Personnel Division	Company human resource management
Ship and Machinery Division	Maintenance and management of electrical equipment, ship machinery and tools
Civil Service Ethics Division	Enforcement of ethics and investigation



» Authorization of environmental management units in the Port of Taichung commercial port area.

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Environmental Management

Environmental Regulation

The Port of Taichung, TIPC upholds the Port Environmental Management Procedure with the assistance of the local responsible authorities in accordance with environmental protection laws. The environmental protection laws applicable to ports are listed in the table below:

»Domestic port environment regulations.

Regulations			Central competent authority	Local law enforcement agencies
Transportation regulations	The Commercial Port Law	2011/12/28	Ministry of Transportation & Communications	Central Taiwan Maritimes Affairs Center, Maritime and Port Bureau
	The Law of Ships	2010/12/08		
Agriculture regulations	Wildlife Conservation Act	2013/01/23	Council of Agriculture (Executive Yuan)	Agriculture Bureau, Taichung City Government
Interior regulations	Fire Services Act	2011/12/21	Ministry of Interior	Taichung Harbor Fire Brigade
Economic regulations	Petroleum Administration Act	2014/06/04	Ministry of Economic Affairs	Economic Development Bureau, Taichung City Government
Environmental Protection regulations	Marine Pollution Control Act	2014/06/04	Environmental Protection Administration (Administrative Yuan)	Environmental Protection Bureau, Taichung City Government
	Air Pollution Control Act	2012/12/19		
	Basic Environment Act	2002/12/11		
	Toxic Chemical Substances Control Act	2013/12/11		
	Indoor Air Quality Act	2011/11/23		
	Water Pollution Control Act	2015/02/04		
	Waste Disposal Act	2013/05/29		
	Resource Recycling Act	2009/01/21		
	Soil and Groundwater Pollution Remediation Act	2010/02/03		
	Noise Control Act	2008/12/03		
	Environment Impact Assessment Act	2003/01/08		
	Environmental Dispute Resolution Act	2009/06/17		
	Environmental Education Act	2010/06/05		
	Greenhouse Gas Reduction and Management Act	2015/07/01		
	Self-Government Ordinances of Taichung City Develop Low Carbon City	2014/05/09	Taichung City Government	Relative Bureau in Taichung City Government
Cross-department regulations	Disaster Prevention and Protection Act	2012/11/28	Different central and local competent authorities based on disaster type	

State of the Environment

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Resource Consumption

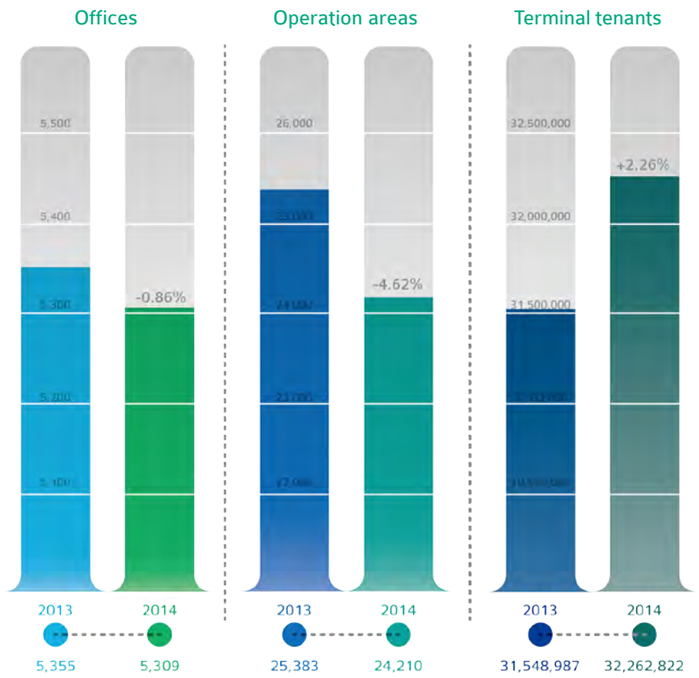
The Port of Taichung, TIPC, has compiled statistical data on the water, electricity, fuel, and paper consumption of its offices and public areas to determine the usage by each department and to make improvements.

Water Consumption

Water use at the offices of Taichung Port: 5,355 m³ of water was used in 2013 and 5,309 m³ of water was used in 2014.

Operation Areas: 25,383 m³ of water was used in 2013 and 24,210 m³ of water was used in 2014.

Terminal tenant water consumption of Taichung Port: 31,549,000 m³ of water was used in 2013 and 32,263,000 m³ of water was used in 2014.



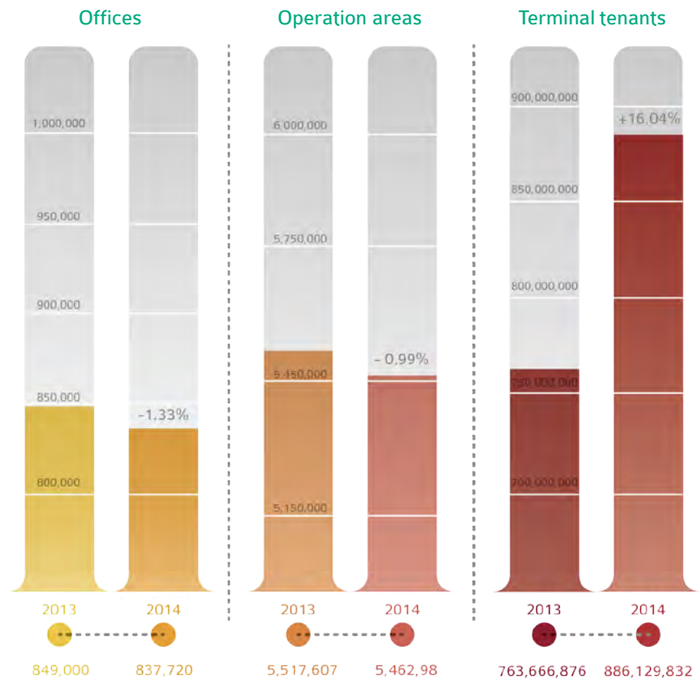
»2013-2014 Total Water Consumption at Port of Taichung, TIPC

Electricity Consumption

Electricity consumption at Port of Taichung, TIPC offices: Approx. 849,000 kilowatt hours (kwh) of electricity were used in 2013 and approx. 837,720 kilowatt hours (kwh) of electricity were used in 2014.

Operation Areas: Approx. 5,517,607 kilowatt hours (kwh) of electricity were used in 2013 and approx. 5,462,981 kilowatt hours (kwh) of electricity were used in 2014.

Terminal Tenants: Approx. 763,666,876 kilowatt hours (kwh) of electricity were used in 2013 and approx. 886,129,832 kilowatt hours (kwh) of electricity were used in 2014.



»2013-2014 Electricity Consumption by Port of Taichung, TIPC

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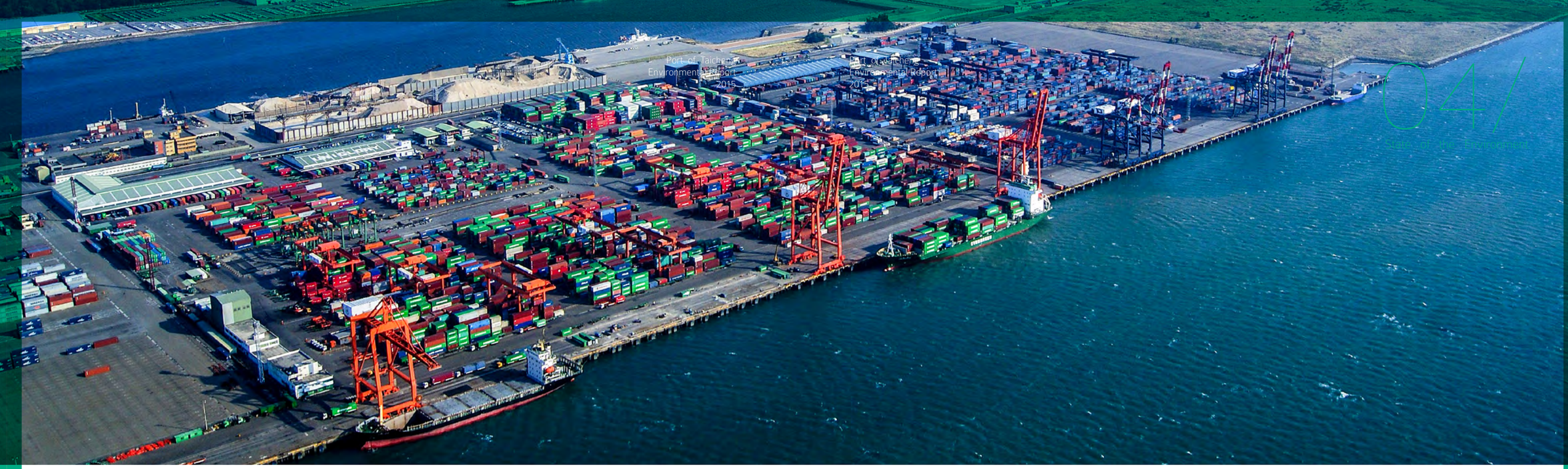
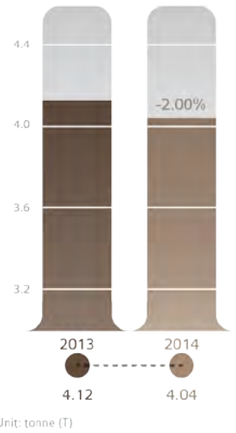


Paper Consumption

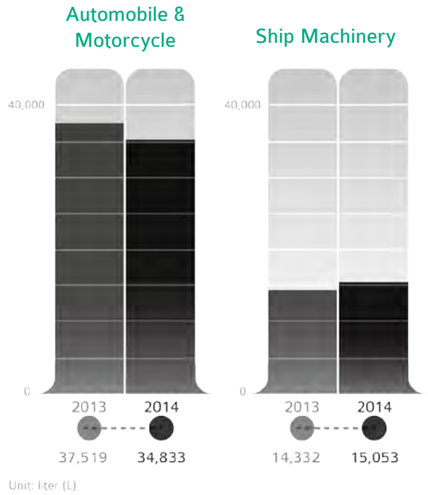
Paper consumption of Port of Taichung, TIPC offices: 824,500 sheet of paper (approx. 4.12 metric tons) were used in 2013 and 808,000 sheet of paper (approx. 4.04 metric tons) were used in 2014.



»2013-2014 Paper Consumption at Port of Taichung

Fuel Consumption

Port of Taichung, TIPC fuel consumption: Total fuel use in 2013 was approx. 51,851.08 liters and 49,886.06 liters of fuel were used in 2014.



»2013-2014 Fuel Consumption at Port of Taichung

Resource Conservation Rate

In summary, resource usage by Taichung Port tenants is directly proportional to the number of transactions managed by each company; hence, controlling the amount of used resources is difficult. Resource usage by offices and operation areas can be controlled through internal company announcements. Action plans to promote energy conservation and carbon reductions have been implemented to control resource consumption successfully in port areas.

»2013-2014 Resource Conservation Rate at Port of Taichung, TIPC Offices

Year	Water use (m^3)	Fuel use (liters)	Electricity use (kwh)	Paper use (sheets)
2013	5,355	51,851.08	849,000	824,500
2014	5,309	49,886.06	837,720	808,000
Conservation Rate	0.86%	3.79%	1.33%	2.00%

»2013-2014 Resource Conservation Rate at Port of Taichung Operation Areas

Year	Water Use (m^3)	Electricity Use (kwh)
2013	25,383	5,517,607
2014	24,210	5,462,981
Conservation Rate	4.62%	0.99%

»2013-2014 Resource Conservation Rate by Port of Taichung Terminal Tenants

Year	Water Use (m^3)	Electricity Use (kwh)
2013	31,548,987	763,666,876
2014	32,262,822	886,129,832
Conservation Rate	-2.26%	-16.04%

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Waste & Oily Wastewater

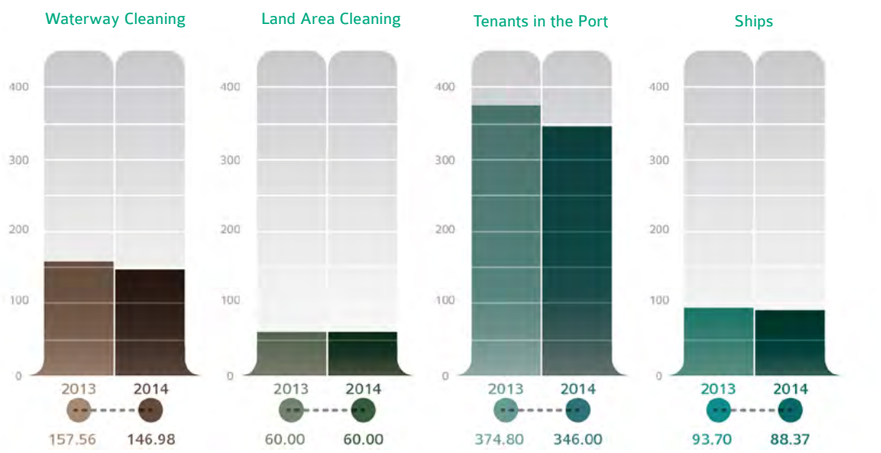
The Port of Taichung, TIPC, is responsible for cleaning general waste produced on land and water, and has divided the port-operating regions into zones that require either road or water cleaning. Disposal operations are announced and contracted out separately. For business waste (including oily wastewater), shippers, terminal tenant, and handling companies each hire businesses qualified to perform waste treatment and disposal operations. In addition, the Port of Taichung, TIPC, collects regular waste daily from ships owned by private and public companies to ensure the normal operation of ships and piers and to maintain a clean port environment.

Waste

The waste produced by the port is primarily from land, waterways, and ships, and ship waste can be divided into that produced by the crew and by travelers. Regarding land waste in the port, outsourcing companies are contracted to collect general industrial waste for the port area. For some private tenant, the Port of Taichung, TIPC, provides assistance with waste transportation. Regarding waste in water areas, the majority of waste is collected at the northern and southern breakwaters and banks. Therefore, the contracted company is responsible for cleaning from the waterways up to 5 m from the coastline. Regarding waste produced by ship crews and travelers, cleaning vehicles collect the waste at shipside. After completion, the waste is sent to the Wuqi and Longjing landfills in Longjing District, Taichung City, for temporary storage. The Longjing District cleaning team is then assigned to transport the waste to an incinerator for disposal.

The Port of Taichung, TIPC, conducts random inspections of port operations to ensure that the waste produced from ship handling is cleaned independently by the carriers and shippers in order to maintain a clean warehouse and dock environment.

Port of Taichung, TIPC waste disposal amounts: A total of 686.06 metric tons of waste were disposed of in 2013 and 641.35 metric tons of waste was disposed of in 2014, representing a 6.52% reduction of total waste disposal amount.



Unit: tonne(T)

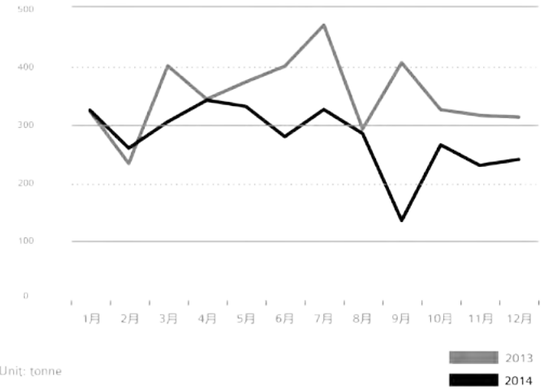
»2013-2014 Waste Disposal Amounts at the Port of Taichung, TIPC

Oily Wastewater

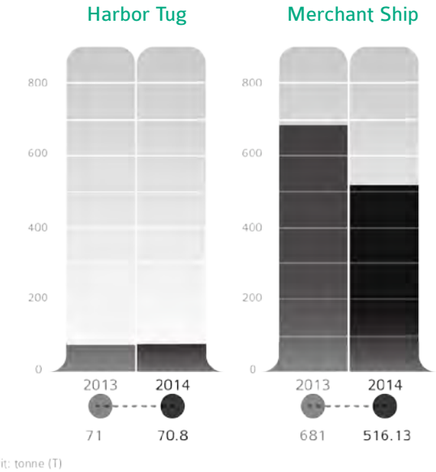
Ships are primarily responsible for the production of oily wastewater in the port area. The carrier (i.e., shipping agency) submits an oily wastewater cleaning application, which is reviewed by the Port of Taichung, TIPC. Information such as the scheduled disposal time, the dock, ship name, and disposal amount are noted, and a cleaning (disposal) company performs the disposal tasks as indicated in the application. At the beginning of each month, the Port of Taichung, TIPC generates the Port Ship Oily Wastewater Disposal Statistics Table by compiling data from the previous month, which is submitted to the Environmental Protection Administration and the Environmental Protection Bureau of Taichung City.

Port of Taichung, TIPC oily wastewater disposal amounts: A total of 752.00 metric tons of oily wastewater were disposed of in 2013 and 586.93 metric tons of oily wastewater was disposed of in 2014, representing a 21.95% reduction of total oily wastewater disposal amount.

Company qualifications: Disposal companies must provide relevant certification documents (i.e., a waste disposal permit approved by an environmental protection authority, a business plan, an emergency response plan, and permission to access the site). A shipper (i.e., shipping agent) submits the disposal application, which is reviewed by the Port of Taichung, TIPC, and provides information such as the scheduled disposal time, pier, ship name, and disposal amount. Finally, the hired disposal (transportation) company conducts the disposal operations in accordance with the application.



Unit: tonne



Unit: tonne (T)

» 2013-2014 Oily wastewater Disposal Amounts at the Port of Taichung, TIPC

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Resource Recycling

Trash collection for the Taichung port area is contracted out to a disposal company to perform the sorting and handling. The collected waste is sorted at a site prepared by the contracted company in accordance with the regulations, after which it is transported to a legal site designated for disposal. In addition, the Port of Taichung, TIPC, arranges for garbage and recycling trucks to collect waste produced by each department on every weekday. The majority of resources recycled for the Port of Taichung, TIPC, are scrap iron (including cans, barrels, and bars), paper waste, glass waste, aluminum waste (including aluminum cans and aluminum alloys), and plastic waste (ordinary plastic; excluding plastic bags), which encompass PET bottles, plastic containers, electronic equipment, and appliances (including washing machines, televisions, computers, and lead storage batteries).

Total resource recycling at Port of Taichung, TIPC: A total of 33.909 metric tons of resources were recycled in 2013 and a total of 72.579 metric tons of resources were recycled in 2014.

Scrap iron recycling amounts at the Port of Taichung, TIPC: A total of 2.904 metric tons of scrap iron were recycled in 2013 and a total of 3.452 metric tons of scrap iron were recycled in 2014, representing a 18.87% increase of total scrap iron recycling amount.

Waste paper recycling amounts at the Port of Taichung, TIPC: A total of 11.612 metric tons of waste paper were recycled in 2013 and 25.442 metric tons of waste paper were recycled in 2014. Waste glass recycling amounts at the Port of Taichung, TIPC: A total of 12.119 metric tons of waste glass were recycled in 2013 and 37.600 metric tons of waste glass was recycled in 2014, representing a 210.26% increase of total waste glass recycling amount. Representing a total increase of 119.10% in the waste paper recycling amount.

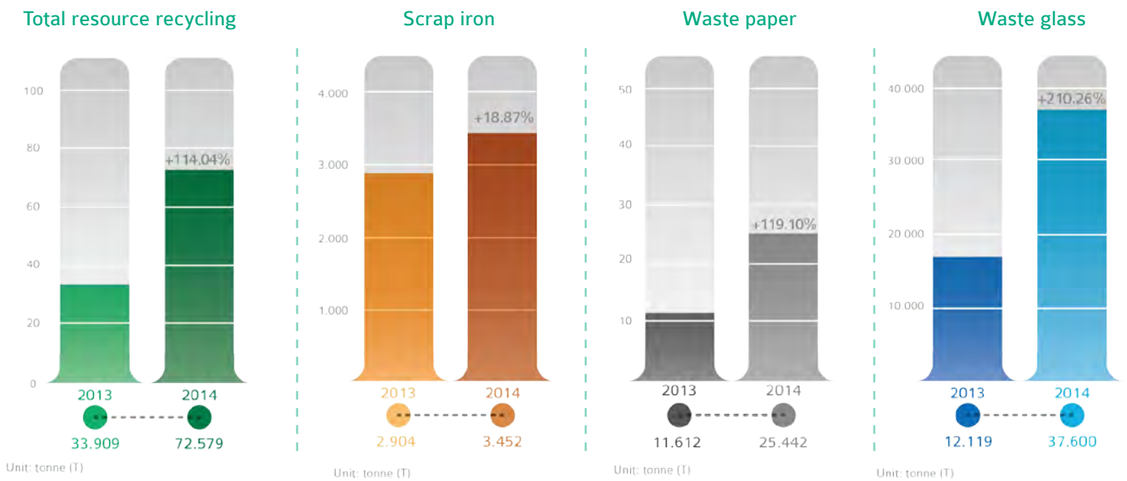
Waste glass recycling amounts at the Port of Taichung, TIPC: A total of 12.119 metric tons of waste glass were recycled in 2013 and 37.600 metric tons of waste glass was recycled in 2014, representing a 210.26% increase of total waste glass recycling amount.

Waste aluminum recycling amounts at the Port of Taichung, TIPC: A total of 1.638 metric tons of waste aluminum were recycled in 2013 and 0.856 metric tons of waste aluminum was recycled in 2014, representing a 47.74% increase of waste aluminum recycling amount.

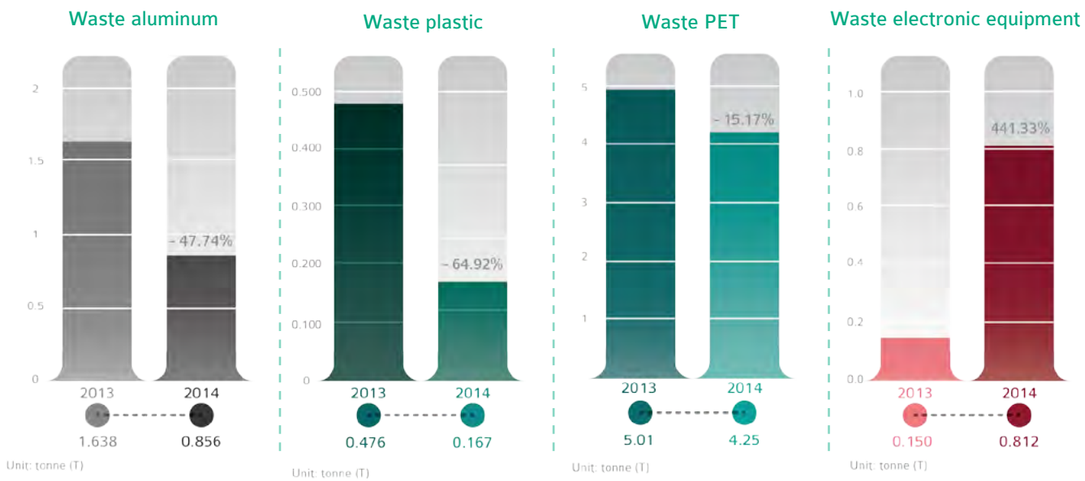
Waste plastic recycling amounts at the Port of Taichung, TIPC: A total of 0.476 metric tons of waste plastic were recycled in 2013 and 0.167 metric tons of waste plastic were recycled in 2014, representing a 64.92% decrease of total waste plastic recycling amount.

Waste PET bottles and plastic container recycling amounts at the Port of Taichung, TIPC: A total of 5.01 metric tons of waste PET bottles and plastic containers were recycled in 2013 and a total of 4.25 metric tons of waste PET bottles and plastic containers were recycled in 2014, representing a 15.17% decrease of total PET bottle and plastic container recycling amount.

Waste electronic equipment recycling amounts at the Port of Taichung, TIPC: A total of 0.150 metric tons of waste electronic equipment were recycled in 2013 and 0.812 metric tons of waste electronic equipment was recycled in 2014, representing a 441.33% increase of total waste electronic equipment recycling amount.



» Recycling Amounts at the Port of Taichung, TIPC



» Recycling Amounts at the Port of Taichung, TIPC

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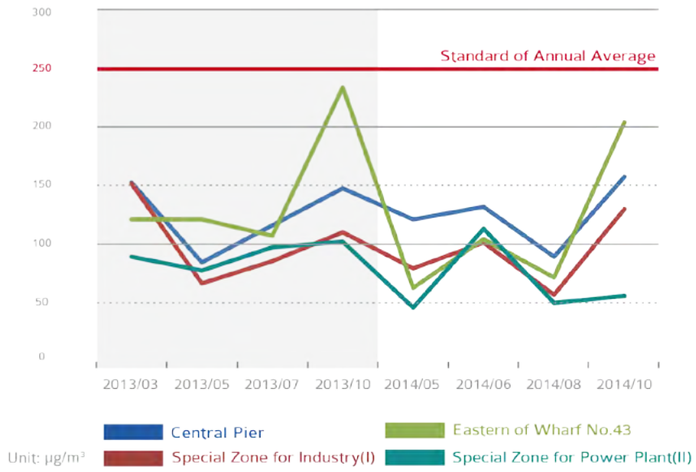
Air Quality

The major factors of air pollution in the Taichung port are the transfer of outdoor pollution, outdoor stacking, black smoke emitted from ships, vehicle exhaust, dust from handling, the photochemical effect, and smokestack emissions from the Taichung Power Plant and Dragon Steel Factory in the port area, which have contributed to higher levels of suspended particulate matter in the port area.

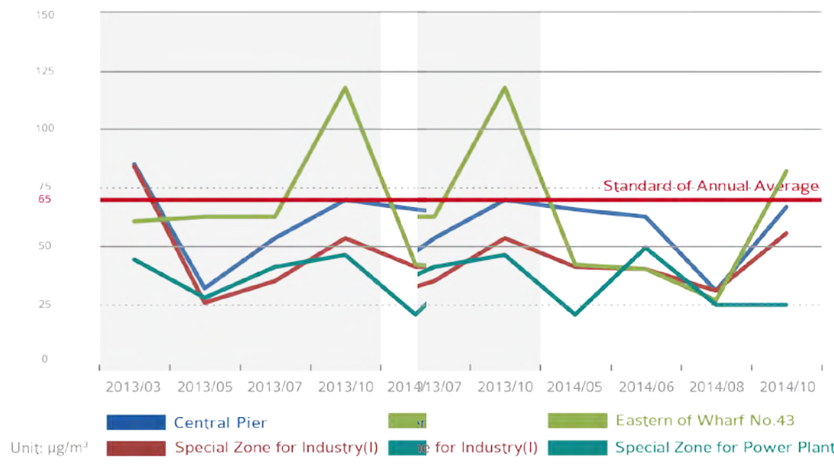
The Port of Taichung, TIPC, conducts long-term air-monitoring for the continued understanding of the air quality status in the port area. The monitored items include total suspended particulate matter (TSP), particulate matter equal to or less than 10 microns (PM_{10}), fine particles ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), methane (CH_4), nonmethane hydrocarbon (NMHC), and total hydrocarbons (THC). The monitoring data show that the air-quality monitoring results for the Taichung port area generally meet the air quality standards established in Article 5-3 of the Air Pollution Control Act.

Spatial analysis of the 2013 air-quality monitoring data revealed relatively high TSP levels in the port area for the first and fourth quarters of the year. The levels were especially high at the Central Pier, the Special Zone for Industry, and No. 43 pier. The higher TSP levels were due to the handling of gravel and ore around the Central Pier, and the handling of coal as well as the coal placement area located at No. 40 and No. 43 pier.

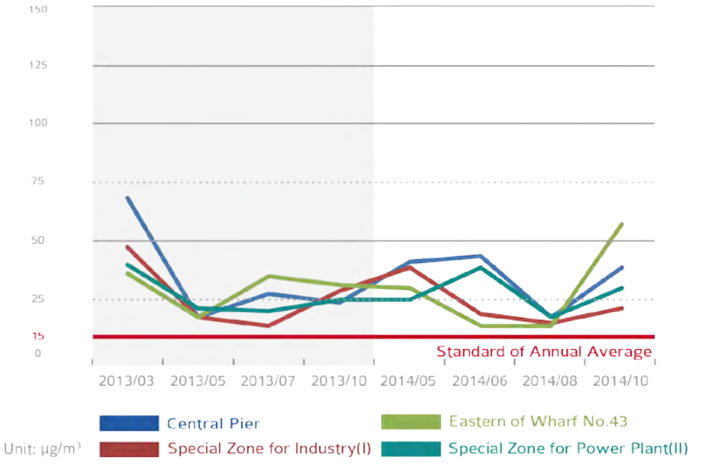
The Port of Taichung, TIPC, has cooperated with companies to request that bulk carrier handling be performed in closed areas whenever possible to minimize outdoor handling operations. In addition, closed warehouses, indoor handling, dust screens, and suction sweepers are used. These measures were implemented to improve air pollution conditions in the Port of Taichung. Furthermore, a new air-quality monitoring station will be established in the southwest area of the Taichung port to gain a greater understanding of the environmental conditions and improve the air quality further.



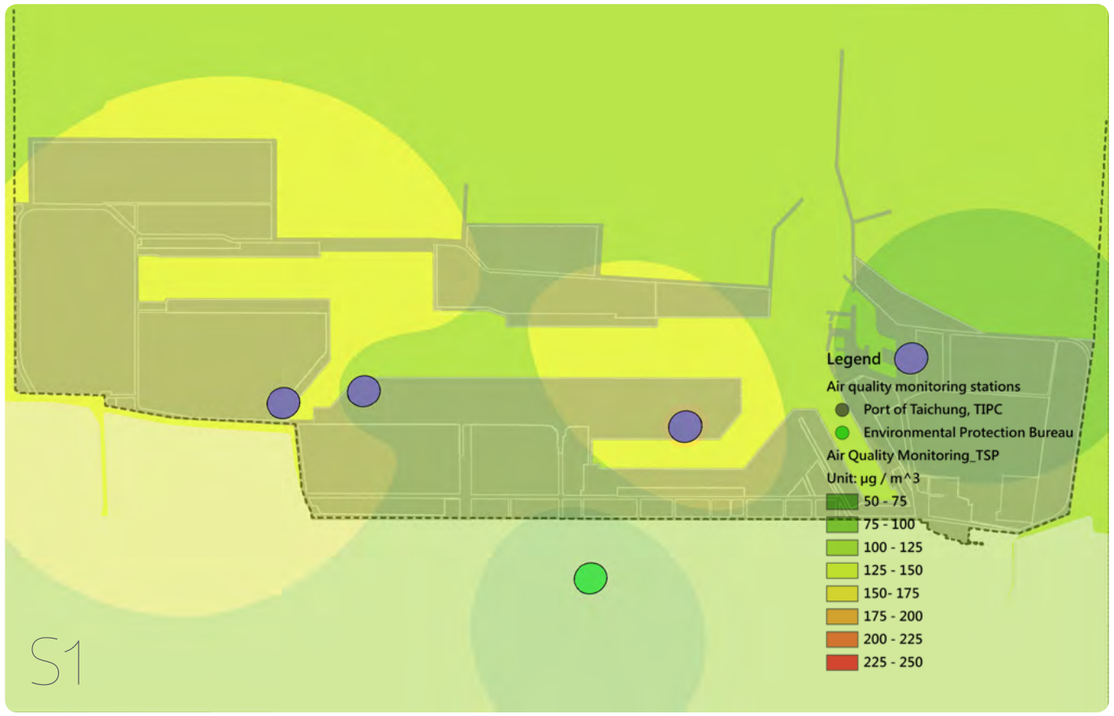
» 2013-2014 Air Quality Monitoring in Taichung Port – TSP

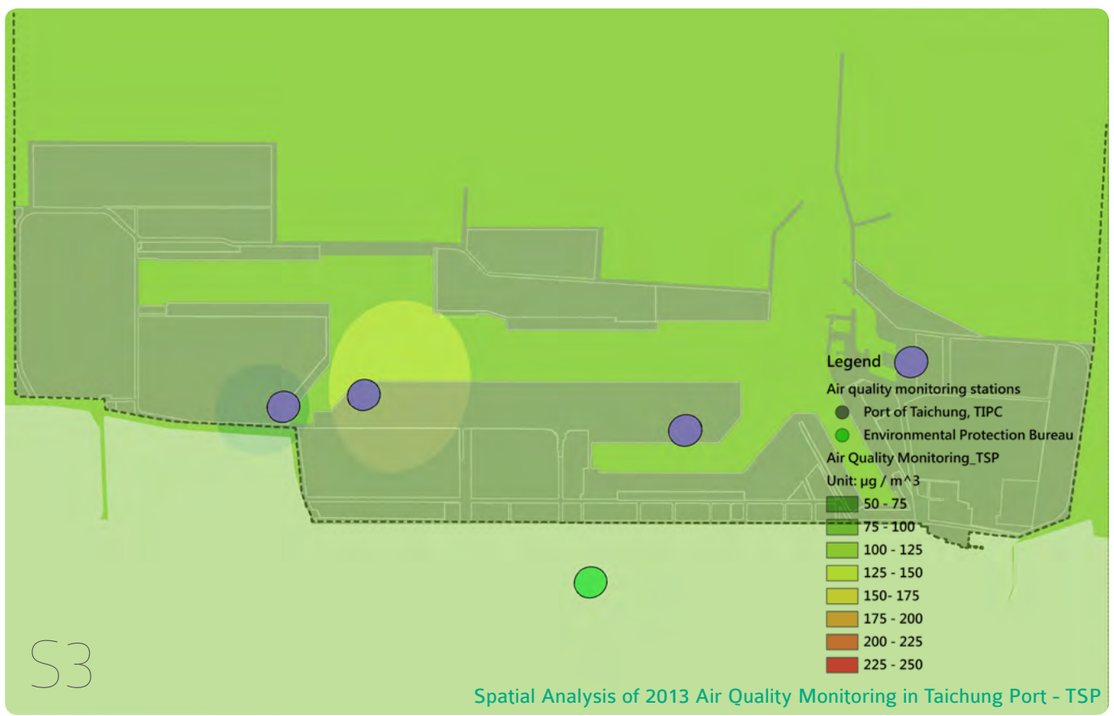


» Air Quality Monitoring in Taichung Port - PM_{10}

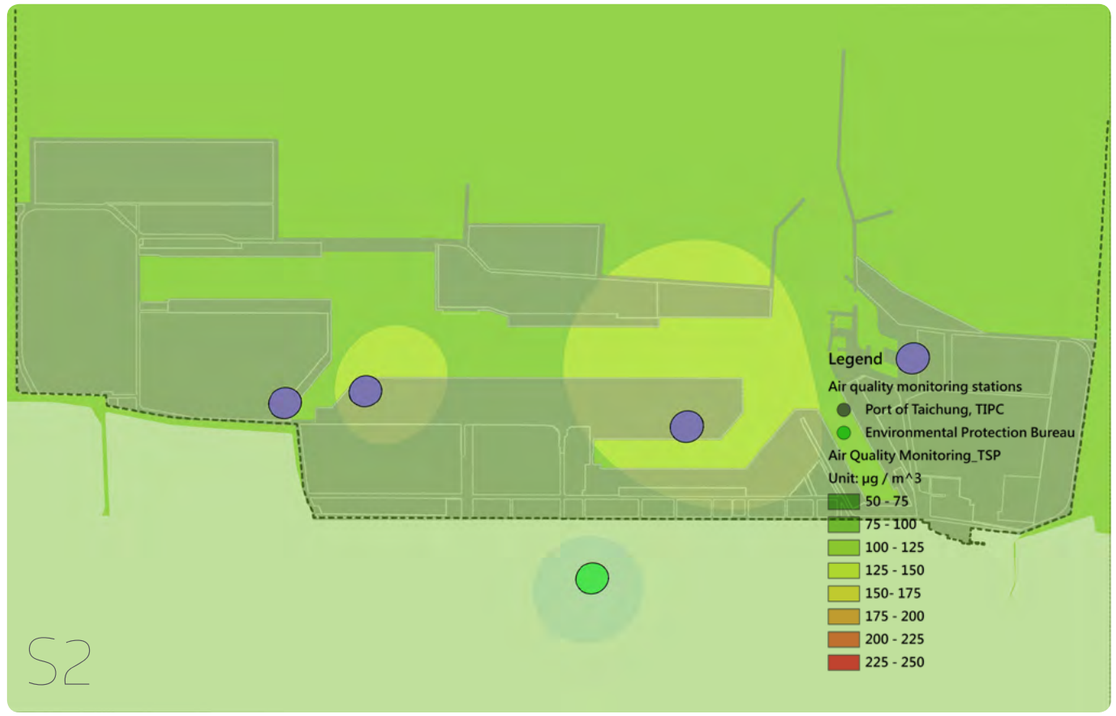


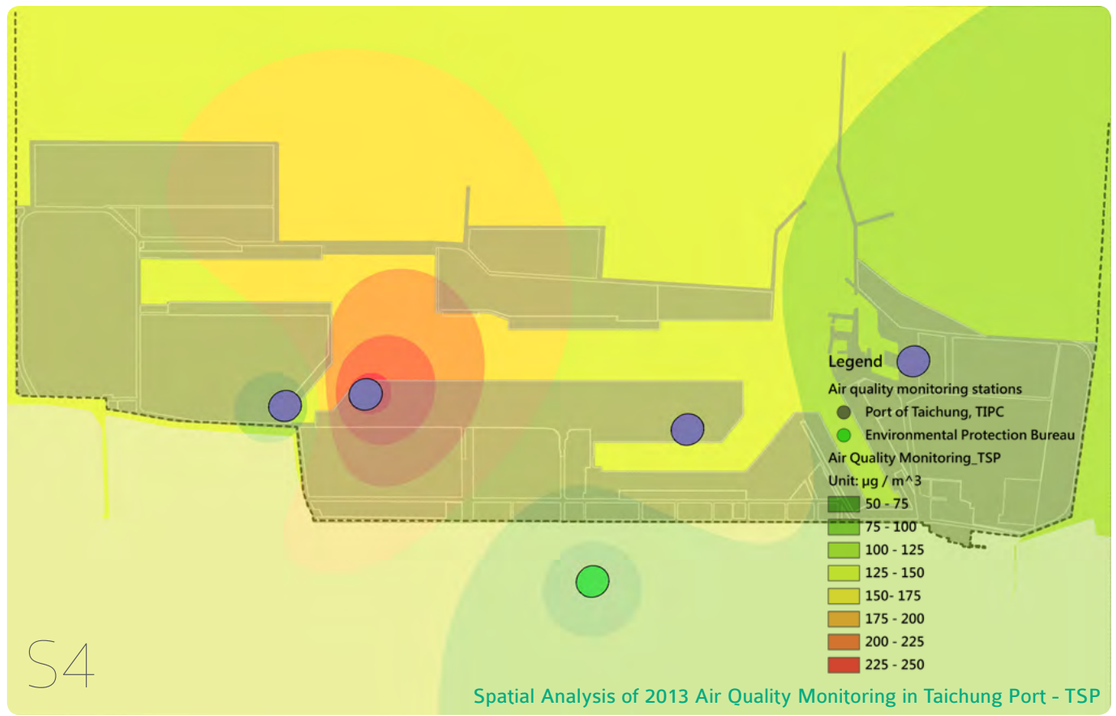
» 2013-2014 Air Quality Monitoring for Taichung Port - $PM_{2.5}$





Spatial Analysis of 2013 Air Quality Monitoring in Taichung Port - TSP





Spatial Analysis of 2013 Air Quality Monitoring in Taichung Port - TSP

Greenhouse Gas Emissions

Increases in greenhouse gas concentrations easily induce dramatic changes in climate conditions and generate compound disasters, which lead to significant human, property, and environmental losses. Therefore, greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), and nitrogen dioxide (N_2O), as well as synthetic gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), are controlled under the 2005 Kyoto Protocol. These six items have been listed as reduction control targets, and each industry emission is listed to be quantified for inventory, verification, and carbon-trading units. Because of relatively major changes to the steam and ozone spatial distribution, steam and ozone are generally not considered in reduction-measure strategies. For greenhouse gas controls in the port area, Taichung port operations contribute a substantial amount of emissions, the sources of which include inbound and outbound ships and factories as well as transportation vehicles. Large-scale resource consumption generates a considerable amount of carbon emissions. Therefore, the Taichung City government has been actively promoting total carbon emission controls, and has implemented self-governance ordinances for the low-carbon development of Taichung City. As part of these regulations, quantitative inventories of greenhouse gas sources in the port area are conducted to estimate the emissions and/or the sequester of various modes of operation, after which companies are required to submit reduction plans to reduce overall greenhouse gas emission levels in the port area.

Carbon Emissions from Resource Consumption

Carbon emissions resulting from Taichung Port resource consumption were calculated using the carbon emission factors established by the Taiwan Water Corporation, Bureau of Energy, MOEA, and Chung Hwa Pulp Corporation. The carbon emission amount calculated for the Taichung port was 407,005,877 kg in 2013, and 471,003,765 kg in 2014, indicating a 15.72% increase of total carbon emissions.

»2013-2014 Carbon Emissions of Resource Consumption by Port of Taichung , TIPC (unit: $KgCO_2e$)

Resource	2013		2014	
	Amount of Resource Consumption	Carbon Emissions	Amount of Resource Consumption	Carbon Emissions
Water	31,579,725(m^3)	4,926,437	32,292,341(m^3)	5,037,605
Fuel	51,851.08(L)	117,344	49,886.06(L)	112,897
Electricity	770,033,483(kWh)	401,957,478	892,430,533(kWh)	465,848,738
Paper	824,500(sheets)	4,617	808,000(sheets)	4,525
Total	-	407,005,877	-	471,003,765

Note: CO_2 factor-Water: 0.156 $KgCO_2e$ / m^3/day (2013); Power: 0.522 KgCO2e / kwh(2013); Fuel: 2.2631 $KgCO_2e$ /liter; Paper: 2.8 $KgCO_2e$ / 500 sheets (A4,70 pounds)

Carbon Emissions from Ships

The Taiwan air pollution emission [TEDS8.1] line source manual-calculation formula was applied for carbon emissions from ocean-going vessels:

Note: Fuel consumption amount (L) = Cargo throughput (L)× Energy density (L/ton kilometer)× Harbor travel distance (km)×1000 (kg/metric ton)
Assuming the ship switches to marine diesel oil when entering the harbor, its properties are similar to regular diesel fuel. Therefore, the 2013 diesel fuel carbon emission factor in the EPA carbon factor database was consulted for the emission factor.

Ocean-going ship carbon emissions($KgCO_2e$) =

Fuel consumption amount (L)× Emission factor($KgCO_2e$/L)× Control factor

» 2013-2014 Ocean-Going Ship Carbon Emissions in Taichung Port (Unit: $KgCO_2e$)

Year	Total Cargo Throughput (metric ton)	Energy Density (liter / metric ton km)	Harbor Travel Distance(km)	Unit	Fuel Consumption(L)	Emission Factor ($KgCO_2e$/ Liter)	Carbon Emissions
2013	70,084,123	0.003	1	Liter	210,252,369	3.45	725,370,673
2014	72,305,322				216,915,966		748,360,083

Carbon Emissions from Port Vehicles

The Taiwan air pollution emission [TEDS 8.1] line source manual-calculation formula was adopted to estimate inbound and outbound container truck carbon emissions:

Total number of vehicles per year= [Total cargo throughput (TEU) - Container transshipment throughput (TEU)]÷2
The container transshipment throughput produced 115,089 TEU in 2013, and 109,498 TEU in 2014.
Automotive Research & Testing Center data were reviewed to determine the average fuel consumption in the port area. The monthly fuel consumption was calculated as 2.47 km/L. The research findings by Harbor and Marine Technology Center, MOTC, were also reviewed. The average travel distance to Taichung port is 6.31 km, and the round-trip distance is 12.62 km. Thus, Taichung port fuel consumption was estimated as 5 L.

Container truck carbon emissions(KgCO2e)=

Total number of vehicles per year × Average fuel consumption(L) in the port area× Emission factor(KgCO2e/L)× Control factor

» 2013- 2014 Carbon Emissions of Container Truck in Taichung Port (Unit: $KgCO_2e$).

Year	Inward / Outward Container Throughput (TEU)	Heavy Goods Vehicle Carrying Limit (TEU)	Unit	Total Trips per Year	Fuel Consumption (liter)	Emission Factor ($KgCO_2e$/ liter)	Carbon Emissions
2013	1,352,516	2	No of vehicles	676,258.0	5	3.45	11,665,451
2014	1,404,261			702,130.5			12,111,751

In summary, ships were found to be the major source of carbon emissions for the port. The Port of Taichung, TIPC, is highly concerned about this problem, and has begun introducing carbon reduction measures such as by installing shore power equipment at piers and promoting the curtailing of the vessel speed. The Port of Taichung, TIPC, aims to curtail vessel speeds by 40% in 2016, and by 50% in 2017.

» Shore Power Equipment Installation at Taichung Port

Item	Pier No.	Pier Type	Voltage	Power	Year Constructed
1	Work basin	Basin	220V	4,00KVA	1996
2	19A	Passenger ship	440V	1,000KVA	2013
3	18	Bulk cargo	Pipeline installation have been planned to meet new Pier construction requirements. Equipment shall be installed after the shore power equipment standards and specifications have been established.		
4	44	Bulk cargo			
5	45	Bulk cargo			
6	105	Bulk cargo			

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Noise

Taichung port operations do not easily result in noise disturbances for neighboring residents. According to the Noise Control Zone Designation Guidelines under Article 6 of the Noise Control Act, the noise-level standards for general areas are determined based on the individual control zone and period. The current Taichung City noise-level control zone map devised by the Environmental Protection Bureau of Taichung City has designated the entire Taichung port area as a Class 4 control zone for industrial noise-level controls. The full-range equivalent noise-level standards (20 Hz to 20 KHz) are divided by time, with 80 dB in the day (7:00 AM to 7:00 PM), 70 dB in the evening (7:00 PM to 11:00 PM), and 65 dB at night (11:00 PM to 7:00 AM).

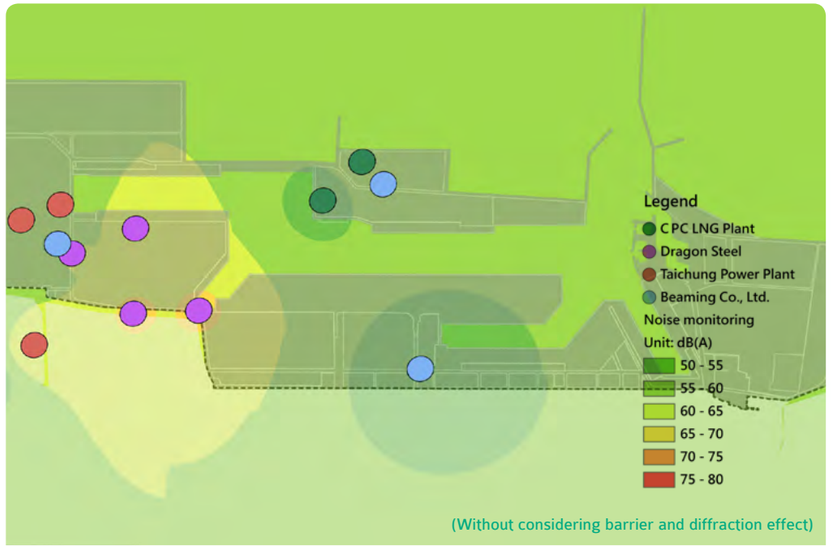
No long-term noise-level monitoring stations are currently situated near the port area borders. The noise-monitoring station nearest the port area is located at the Port Area Service Center (Shalu District), established by the Environmental Protection Bureau of Taichung City. Monitoring is conducted once every quarter. However, determining the environmental conditions in the port area is difficult because of the long distance from the monitoring station. Thus, the environmental assessment monitoring reports on companies operating in the port area were used as a reference. The noise-monitoring levels from the Taichung Power Plant, Dragon Steel, Beaming Company, and CPC LPG Plant were collated to depict the noise-level environment in the Taichung port area. Although most of the monitoring results met the statutory requirements, the levels in the Dragon Steel area of operations were relatively high, which is indicative of heavy traffic flow in the port area nearby. The Port of Taichung, TIPC, has submitted an improvement scheme to address this concern.

The outbound transportation connection system for the Taichung port is convenient. The transportation network offers numerous options, and thus, traffic diversion within the port area and connecting roads is excellent. Regarding noise-level attenuation, factories are required to install sound-barrier walls around their respective peripheries. Operational tasks that generate noise easily should not be performed near roads, and speed limits should be implemented for roads inside the port area to reduce traffic noise levels. The Port of Taichung, TIPC, is planning to conduct an environmental monitoring analysis for the Taichung port area in 2016 and to install two additional noise-monitoring sites in order to gain a clearer understanding of the environmental conditions and curtail noise disturbances in the port area.

» 2013 Equivalent Energy Sound Level (Leq) for the Taichung Port Area {unit: dB(A)}

Monitoring Unit	Monitoring Station	Daytime Leq	Evening Leq	Nighttime Leq
Taichung Power Plant	TC0 inside plant	60	58	58
	TC1 North power plant perimeter	61	58	58
	TC2 South power plant perimeter	65	62	62
	TP1 Power plant entrance	72	66	65
	TP5 Lishui surface observation area	56	51	50
	TP6 Lishui household	57	53	52
Dragon Steel	P1	70	63	62
	P2	70	63	63
	P3	72	66	65
	P4	73	66	65
Beaming Co., Ltd.	Plant site	67	58	62
	Port of Taichung, TIPC	62	51	63
	Longchang Rd. household	63	51	65
CPC LNG Plant	Monitoring site inside plant	54	52	52
	Monitoring site outside plant	66	57	59
Control Area IV Standard		80	70	65

»2014 Spatial Analysis of Daytime Leq Noise Level in Taichung Port Area



»2014 Spatial Analysis of Evening Leq Noise Level in Taichung Port

»2014 Spatial Analysis of Nighttime Leq Noise Level in Taichung Port

Water Quality

A number of canals from Taichung City flow into the Taichung port, including city canals, domestic wastewater from the port, and factory wastewater drainage. Combined with fugitive dust particles resulting from handling and blowing sand, this shows that many pollutants affect the port basin. Despite the excellent tidal range in the Taichung port and the tidal flows carrying away some of these pollutants, the Port of Taichung, TIPC, as the terminal operator of the port, is responsible for reducing potential pollution factors affecting the port area. The Port of Taichung, TIPC, has devised long-term schemes for monitoring the water quality, ecology, and sediments in the port area. The monitoring results can be used as a referential foundation for water-quality control and as a reference for future water quality improvements.

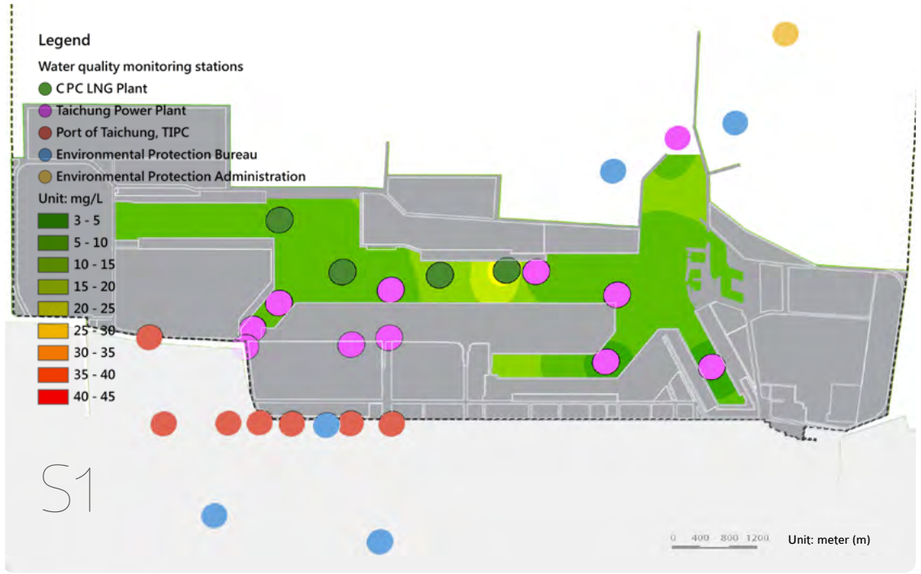
Water Quality Monitoring

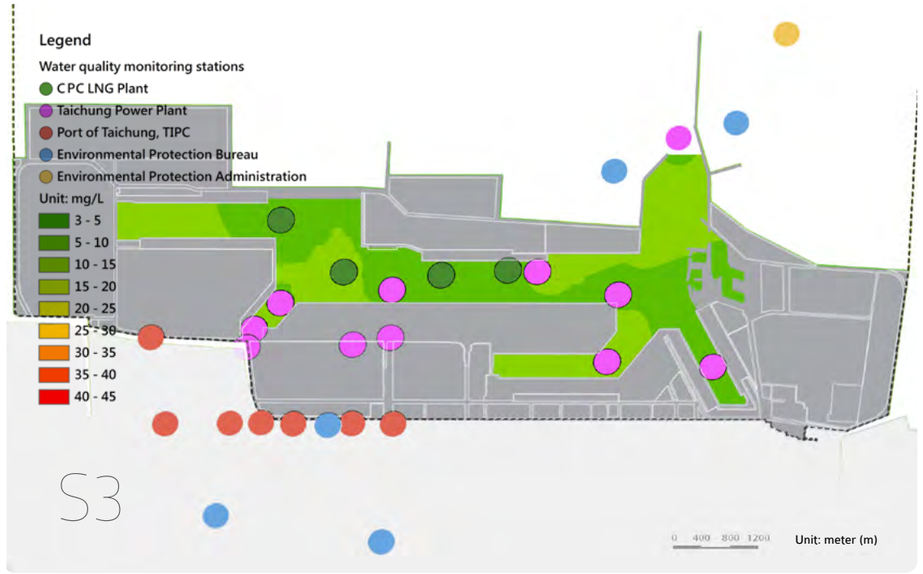
The Port of Taichung, TIPC, performs mainly long-term water-quality monitoring within the Taichung port area, and the Environmental Protection Administration and the Environmental Protection Bureau of Taichung City conduct monitoring activities around the periphery of the port area. To fulfill the environmental assessment requirements, companies in the port area are conduct long-term environmental monitoring (e.g., the CPC LNG Plant, Taipower Power Plant, and Taichung Export Processing Zone). The Port of Taichung, TIPC, has established 19 monitoring stations to monitor the sea, land, and effluent water quality. Two monitoring stations of the Environmental Protection Administration are located in the waters outside the port area, and they monitor mainly the port mouth and Taipower Power Plant effluents. Three monitoring stations of the Environmental Protection Bureau of Taichung City are located in the waters outside the port, and four other monitoring stations are located around canals upstream from the port. Not all monitored water-quality items for each department are the same, but most include hydrogen ion concentration, chemical oxygen demand, mineral oil, suspended solids, biochemical oxygen demand, the coliform group, cyanide, total phosphorus, dissolved oxygen, phenols, and ammonia.

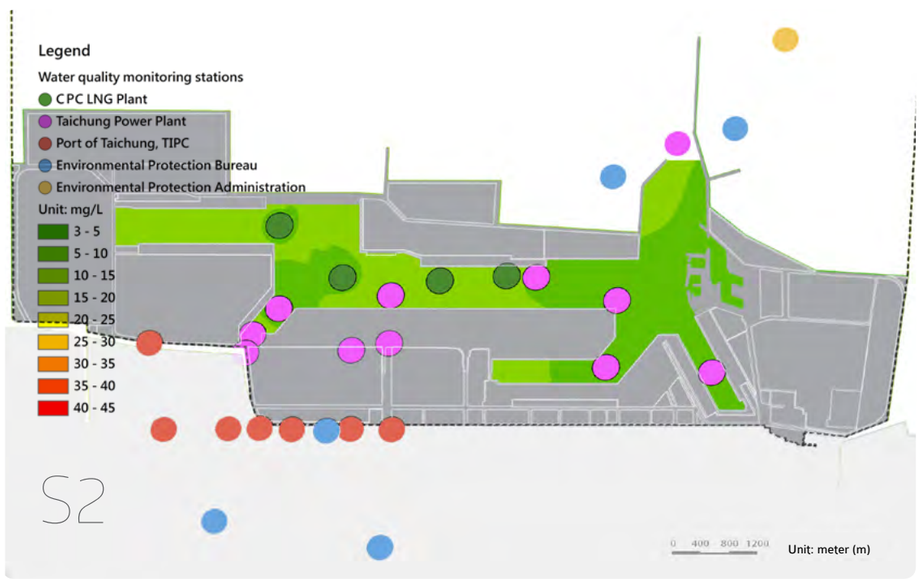
According to the Marine Environment Classification and Marine Environment Quality Standards under Article 8-1 of the Marine Pollution Control Law, the marine environment is divided into Classes A, B, and C. Class B marine environment quality standards concern open seas. Except for areas near canals, which exceed regulatory standards because they are affected easily by upstream pollution, the monitoring results fulfilled the regulatory requirements, showing that long-term water-quality improvements conducted by the Port of Taichung, TIPC, have been effective.

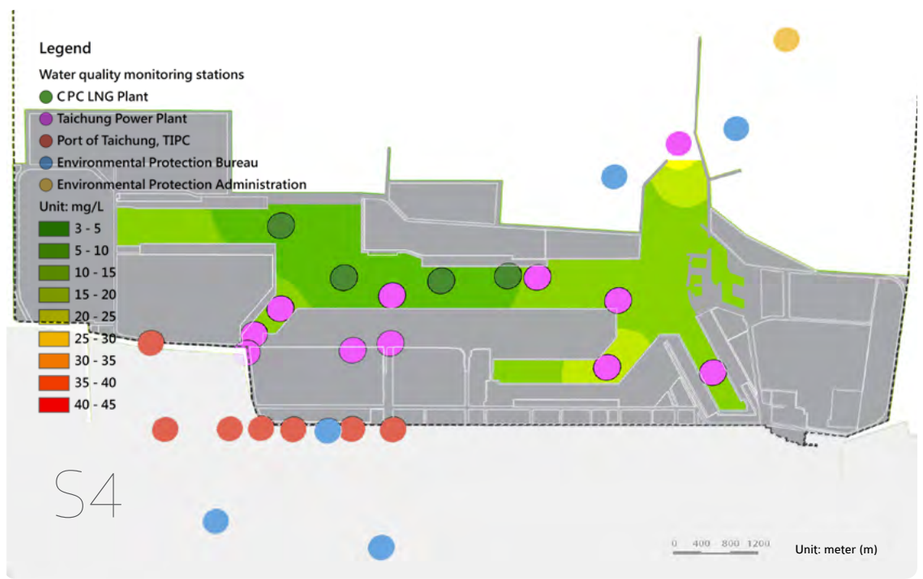
In addition, spatial analysis of the suspended solids in the port area waters revealed that the most serious long-term consequences are from the Northeast Monsoon. At the beginning and end of each year, a large amount of sand is blown from the north. To address these problems, the Port of Taichung, TIPC, has implemented a Casuarina planting scheme to improve the blowing-sand conditions, and has strengthened controls for outdoor bulk cargo handling to ensure prevention measures against fugitive dust. The analytical results revealed extremely low levels of suspended solids in the port area waters.

Regarding polluted water flowing into the port area, the Port of Taichung, TIPC, has strengthened the controls for port industry wastewater and oily wastewater from ships in accordance with Environmental Protection Administration policies. Moreover, it collaborates with the local Environmental Protection Bureau to reduce water pollution by promoting potentially polluted catchments located upstream from the port area. In addition, inspection personnel are regularly assigned to examine overseas ship oil waste and the water discharged into the port area from medium-sized and large canals. The Port of Taichung, TIPC, also performs waste collection to reduce the negative impact of oily wastewater on the Taichung port basin.





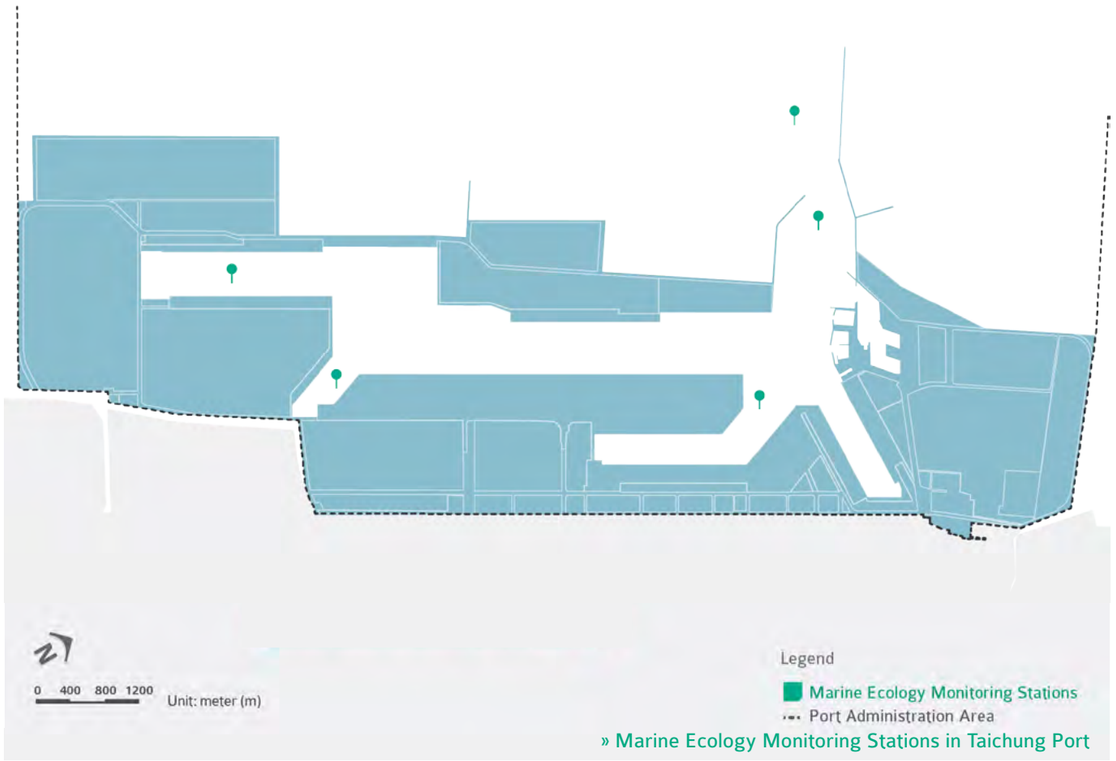




Marine Ecology

Water ecology monitoring in the Taichung port is planned and performed mainly by the Port of Taichung, TIPC. Companies in the port area also conduct long-term environmental monitoring in accordance with environmental assessment requirements. Five water ecology monitoring stations have been installed by the Port of Taichung, TIPC. The monitored items include phytoplankton, zooplankton, benthonic fish, and heavy metals in aquatic organisms.

Comparing the 2013 and 2014 survey results revealed that both the diversity index and richness index for phytoplankton increased, whereas the homogeneity index decreased, indicating an increase in the type and number of phytoplankton species. The dominance index and richness index for zooplankton increased, whereas the diversity index and homogeneity index decreased, indicating an increase in the number of zooplankton species, but a decrease in type. Some species may have become more dominant. The benthic diversity index and the richness index both increased, indicating that the type and number of benthic species decreased. Both the diversity index and richness index for fish decreased, whereas the dominance index and homogeneity index increased, which is indicative of a decline in the type and number of fish species. The Port of Taichung, TIPC, will continue to track the port water ecology conditions to remain informed of these conditions for maintaining the port water ecology and environment.



» Marine Ecology Monitoring Stations in Taichung Port

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Sediment

The Port of Taichung, TIPC, conducts sediment monitoring in the port area. Ten monitoring stations have been installed for monitoring items including heavy metals such as zinc, cadmium, lead, copper, chromium, nickel, arsenic, mercury, iron, magnesium, and aluminum, as well as total organic matter.

Most of the sediment in the Taichung port is currently used for offshore beach nourishment. According to the Marine Discarded Substance Classifications under Article 22-1 of the Marine Pollution Prevention Law, discarded marine substances are divided into Classes A, B and C. Ocean disposal of Class A substances is forbidden. Comparing the 2013 and 2014 monitoring results against Class B substance standards revealed heavy metal content in the north and central basins, Anliangan drainage channel mouths, the north-turning basin, and piers No. 43. Copper and zinc levels were especially high. These two metals may have originated from upstream canals, from handling, or from copper corrosion in ships. Its long-term accumulation may affect the sediment quality. Therefore, it is impossible to dispose of the sediment dredged from this area in the ocean, and other disposal methods are required.

» 2013-2014 Sediment Monitoring in Taichung Port (Unit: mg/kg)

		Arsenic		Chromium		Copper		Mercury		Nickel		Lead		Zinc	
		1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H
1. North basin		12.5	14.7	25.1	33.9	60.7	46.2	0.123	0.093	35	32.1	33.7	29.3	168	139
2. Central basin		-	14.5	-	41.2	-	69.3	-	0.188	-	34.3	-	47.6	-	214
3. Wuqi drainage canal		10.1	12.6	18.4	19.2	27.1	19.2	<0.1	0.062	25.7	23.3	24.3	21.5	176	82.7
4. Anliangan drainage canal		14.2	12.1	19.8	30.1	27.3	60.5	0.155	0.064	31.9	28.1	30.1	25.8	179	122
5. Industrial basin		14.9	14.2	24.6	45.9	45.7	66.1	<0.1	0.132	37.3	32.3	33.2	44.6	157	209
6. West Terminal basin		15.2	14.2	24.1	32.7	46.8	91.3	<0.1	0.093	36.7	30.2	32.8	33.7	165	156
7.North turning basin		10.2	12.9	N.D.	22.6	41.6	20.9	0.231	0.061	31.3	25.6	20.1	23.5	219	87.9
8. South turning basin		13.2	14.8	19.7	36.4	25.5	64.4	<0.1	0.122	30.5	32.6	27.3	33.8	132	161
9. Between No. 25 & No. 26 Piers		14.1	12	22.4	21.7	62	17.5	<0.1	0.059	35.9	23.1	31.1	20.4	156	80.9
10. No. 43 Pier		11.4	12.6	29	42.7	49.8	69.2	0.101	0.223	36	27.6	38.2	45.7	218	227
Sediment quality index	LCL	11		76		50		0.23		24		48		140	
	UCL	33		233		157		0.87		80		161		384	
Categories of substances disposed in oceans(category B substance standards)		20		60		65		N.D.		70		50		200	
US NOAA sediment biohazard standard	LCL	8.2		81		34		N.D.		N.D.		46.7		N.D.	
	UCL	70		370		270		N.D.		N.D.		218		N.D.	

Note: 1H – first half of year; 2H – second half of year.

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Dredging Management

The Taichung port is located at west of Wuqi District, south of the Dajia River, and north of Dadu River in Taichung City. Each year, 2.50 to 2.60 million m³ of sand is blown from the north to the south; most of it is intercepted by the north breakwater, and subsequently deposited in the northern silt area. However, a portion of the blowing sand breaches the port because of wave and tidal action. In addition, the Wuqi and Anliangancanals, as well as the drainage systems of the Wenyaliao, Yinliang, Tanglang, and Nanjian regions carry silt into the waters.

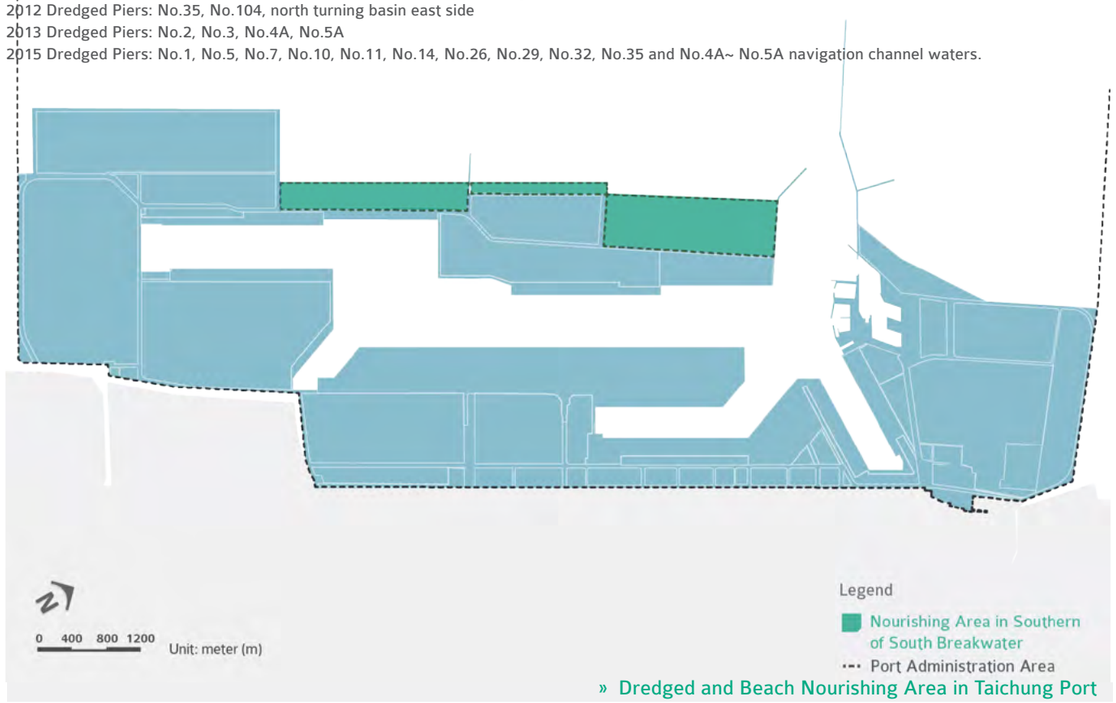
To maintain ship-berthing safety, the Port of Taichung, TIPC, measures the water depth every 6 months, and reviews the water depth and usage status of each pier. Routine maintenance dredging is conducted for the berths and nearby navigation channel waters characterized by severe silting. The dredged earthwork is piled at low-lying land for land reclamation use. However, the low-lying land in Taichung port is full, and a suitable location must be found to store the dredged earthwork.

Different purposes for dredged sediment usage should follow their respective environmental management standards. At present, the monitoring results of Taichung port sediment show that the sediment levels meet the Categories and Usage Restrictions for Sediment Quality Indicator standards, and can thus be used for beach nourishment along the port area. The sediment levels also meet the NOAA sediment biohazard standards. These two standards are commonly used environmental assessments, and thus, the dredged sediment can be used for land reclamation in the port area. However, because the coastal line of the southern breakwater is affected by protruding structures, the longshore drift complicates land reclamation efforts. Consequently, the southern breakwater must undergo frequent maintenance. To fulfill both the dredged earthwork and sea wall protection requirements, the Port of Taichung, TIPC, has extended approaches to dredged earthwork recycling since 2013, and jettisons the dredged earthwork on the coast each year. A temporary sand-fixing site was installed to stabilize the sand, so that the sand could be used for artificial beach nourishment. This work protects the dike foundation on the southern seaside to prevent energy consumption from ocean disposal operations and attenuates the environmental impact on the waters.

» Maintenance Dredging Statistics over the Past Five Years in Taichung Port (Unit: m³)

Year	Estimated Dredging Amount	Actual Dredging Amount	Actual Dredged Silt Disposal Amount	Disposal Site	Monitoring or Other Pollution Prevention Actions
2010 - 2011	136,892.87	121,053.20	121,053	-	
2012	32,520.80	30,220.00	30,220	North breakwater road and north filling area (near No. 5 windmill)	Black net cover in filling area
2013	31,018.00	25,228.00	25,228		
2014	Not contracted out in 2014				
2015	60,151.00	-	60,151	South breakwater seaside beach nourishment	Pollution prevention sheeting installed at dumping area

2010-2011 Dredged Pier: Timber basin waters, east side of north turning basin, No.19 planned Pier site, No.9 Pier outer waters
2012 Dredged Piers: No.35, No.104, north turning basin east side
2013 Dredged Piers: No.2, No.3, No.4A, No.5A
2015 Dredged Piers: No.1, No.5, No.7, No.10, No.11, No.14, No.26, No.29, No.32, No.35 and No.4A~ No.5A navigation channel waters.



» Dredged and Beach Nourishing Area in Taichung Port

Development of Land & Water Areas at the Port

Land Development at the Port

According to the Future Development and Construction of International Ports in Taiwan, TIPC (2012 – 2016) by Taiwan International Ports Corporation, Taichung Port will be developed on the basis of northern, central and southern parts. Development of a water-oriented recreation area in the northern part will include suppression of airborne dust and sand, installation of electrical power (green energy), coastal recreation area conservation, and fishery and forest conservation. The main purpose of this effort is to develop tourism, which will boost economic activity in the port area and enrich the local economy. In the recent years, the Port of Taichung, TIPC has also worked with the Taichung City Government on projects including "Construction of Mermaid Dock at Wuci Fishing Port and Other Related Peripheral Facilities", "Construction of a White Dolphin Ecology Museum in Taichung", "Construction of a New Landscaping Bridge and Improvement of Landscaping of the Roads along the Seawall."

A designated logistic area (free trade ports I-III, warehouse and transshipment center, port services and other specialized areas) will be developed in the central part. An industry chain development area (this area along the West Terminal is intended for use by petrochemical and other industries involving hazardous materials and infrastructure-related industries such as electrical power, petroleum, and steel (Taipower, CPC, Dragon Steel) will be established in the southern part. The southern part will be the main focus of development at Taichung Commercial Port. The "Plan for Quality Port Construction and Green Port Development at the Taichung Port," which was proposed by the Port of Taichung, TIPC, includes construction of port infrastructure that will improve navigation, protect the coast, and facilitate recycling, and will include docks, warehouses and other operational facilities in central and southern parts. The main purpose of this plan is to improve navigation, make the best use of land resources, improve the port's operation and transportation environment, and develop a logistic center. In the future, land use at the Port of Taichung will reflect the three foregoing parts, and docks or facilities that do not meet development needs will be gradually adjusted so as to make Taichung Port a highly efficient port serving distinct purposes, and attracting corporate investment.

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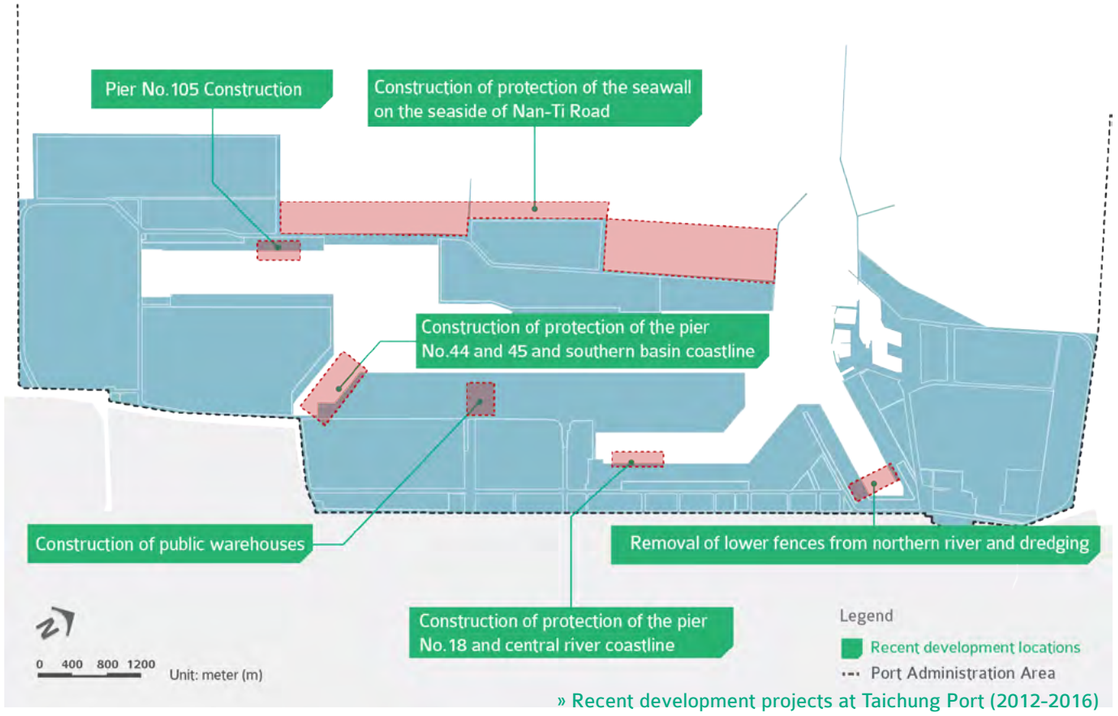
Water Development at the Port

Since its completion, development and expansion work, the Port of Taichung, TIPC has taken the natural environment into consideration. Work such as dust suppression, dredging, and seawall construction have sought to protect this coastal area, and ecological methods have been used in order to minimize impact on the coastal environment and ecology. Bottom sediment removed during dredging have been used for small-scale land reclamation, which has also avoided disposal of sediment in the ocean from having a negative impact on the marine ecology. The ultimate goal of these efforts is to create a green environment.

With regard to Chinese white dolphin conservation, Article 36 of the Commercial Port Act forbids the cultivation and harvest of aquatic plants and the catching and raising of aquatic creatures (fishing is prohibited in the port by law). In addition to legal protection of the Chinese white dolphin, the Port of Taichung, TIPC also plans to continue discussion of a possible "Investigation and Analysis of Chinese White Dolphin Ecology" joint project with the Forestry Bureau (Council of Agriculture, Executive Yuan). TIPC hopes to include Chinese white dolphin conservation with the development of Taichung Port and implement Chinese white dolphin conservation.



» Recent development projects at Taichung Port (2012-2016)

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Port Landscaping

Taichung port is an artificial port built in a beach environment. The port area consists of a flat plain, and the north-east monsoons often cause sandstorms during the monsoon season. The port's shelterbelts and vegetated areas are therefore important projects at the Taichung Port.

Since 1975, the Port of Taichung, TIPC has been planting trees to form shelterbelts at all port construction projects, and has recently also cooperated with the Forestry Bureau to replant trees in the shelterbelts. The Port of Taichung, TIPC is also responsible for mowing lawns in port areas and maintaining vegetated areas surrounding port buildings, along roads in port area, and on the jetty at the south of the port area and in the west pier area. The goal of this work is to promote a green landscaped environment and improve air and environmental quality in the port area. As for investigation of biological organisms, since 2013, the Port of Taichung, TIPC has surveyed biological organisms in the aquatic and terrestrial portions of mudflat areas, north of the extensions of the jetty in the central and northern parts of the phase II Taichung port expansion project (now known as Gaomei Wetland and Low Density Development Area), and the shelterbelts. Based on investigation results, and in compliance with the Wildlife Conservation Act, it was proposed to the Council of Agriculture to exclude Gaomei Wetland from the port area and the wetland was designated a Wildlife Conservation Area in 2004.

In addition to regular maintenance of grassy areas and tree plantations, the Port of Taichung, TIPC has further diversified development of the port area in order to allow certain port areas to serve as the "backyards" of adjacent towns; these areas include landscaped roads in the port area, port parks, and vegetated areas around the port, and they serve to improve the leisure and living environments of adjacent towns and attract more tourists.

The First Landscaped Road in the Port

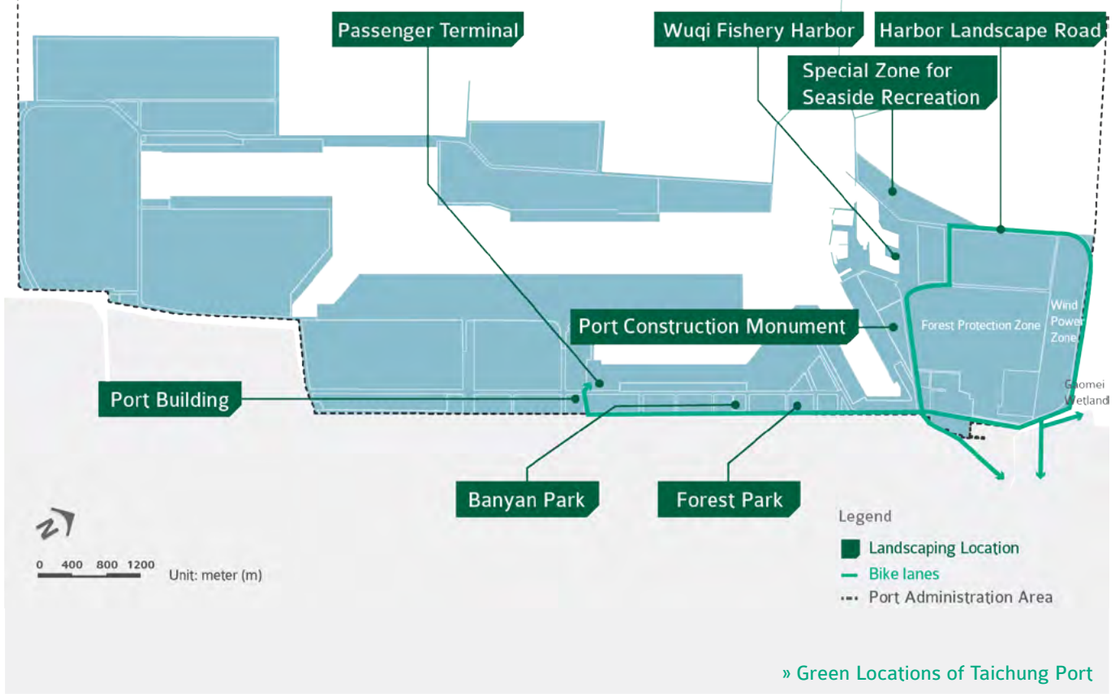
In order to complete the network of access roads in the port and ease traffic congestion, the Port of Taichung, TIPC has constructed the northern segments of Chung-I Road, Northern Embankment Road, and the road that surrounds the shelterbelt. The three roads have a landscaped design, and, in addition to being the main connecting roads in the port, they also serve as scenic roads for recreational and tourism purposes. Together with an 11-kilometer bike path, they connect all tourist attractions in the port with Gaomei Wetland, which forms a diversified recreational belt. Small carts and bicycles can take tourists from the tourist information center to coastal recreation sites, parks, and Gaomei Wetland, which allows them to experience a complete ecological tour. The goal of this work is to provide local residents with diversified leisure and recreational experiences.

Port Parks

In addition to the aforementioned newly-constructed landscaped roads, the Port of Taichung, TIPC also uses some of its land as grassy areas and parks, such as the 6.8-hectare "Forest Park" on Lin-Gang Road (Provincial Highway 17). The Port of Taichung, TIPC is also working with the Public Trees Management Committee to preserve the Temple of Earth God on the northern segment of Chung-I Road and the "Banyan Tree Park." In addition to increasing the ratio of green land in the port, these sites can also serve as stopping points along the bike path. The goal is to achieve a green landscape that breaks the wind, absorbs CO_2 emissions, and provides residents of adjacent towns with places for strolling, exercise, and other outdoor activities.

Adoption of Vegetated Areas in the Port

In the recent years, the Port of Taichung, TIPC has put a great amount of effort into promoting the program "Adoption of Green areas by Companies in the Port Area." In 2015, the Port of Taichung, TIPC signed an adoption contract with the Dasheng Transportation Company calling for the adoption of vegetated areas on the south of the Port's Wuqi Boulevard. Companies in the port not only set a good example for other companies, but also put great effort into landscaping the port environment, thus reducing the maintenance costs of the Port of Taichung, TIPC.Because of its environment, including seasonal droughts and other natural factors, it is very difficult to plant trees and shrubs at the Port of Taichung However, after more than thirty years of effort, the port is starting to show a greener environment. Currently, parks in the port area comprise approximately 8 hectare and green shelterbelts extend for approximately 10 kilometer. Approximately 40 kilometer of traffic islands and sidewalks have been landscaped with trees, and the total area of shelterbelts is as large as 273 hectare. The Port of Taichung, TIPC has further proposed a "project for creating a green environment and reducing CO_2 emissions at Taichung Port" that specifically targets industrial sites for commercial rental purpose within the port area, and prescribes that half of construction land space must be reserved for vegetated areas. As for the port's public areas, the project specifies that green areas shall be at least one-tenth of the land area within the port area, and emphasizes the greening of non-pier surfaces and areas along roads. Trees and shrubs purify the air and reduce pollutant emissions at the port, and ongoing landscaping work seeks to create a garden port and enhance the image of central Taiwan.



» Green Locations of Taichung Port

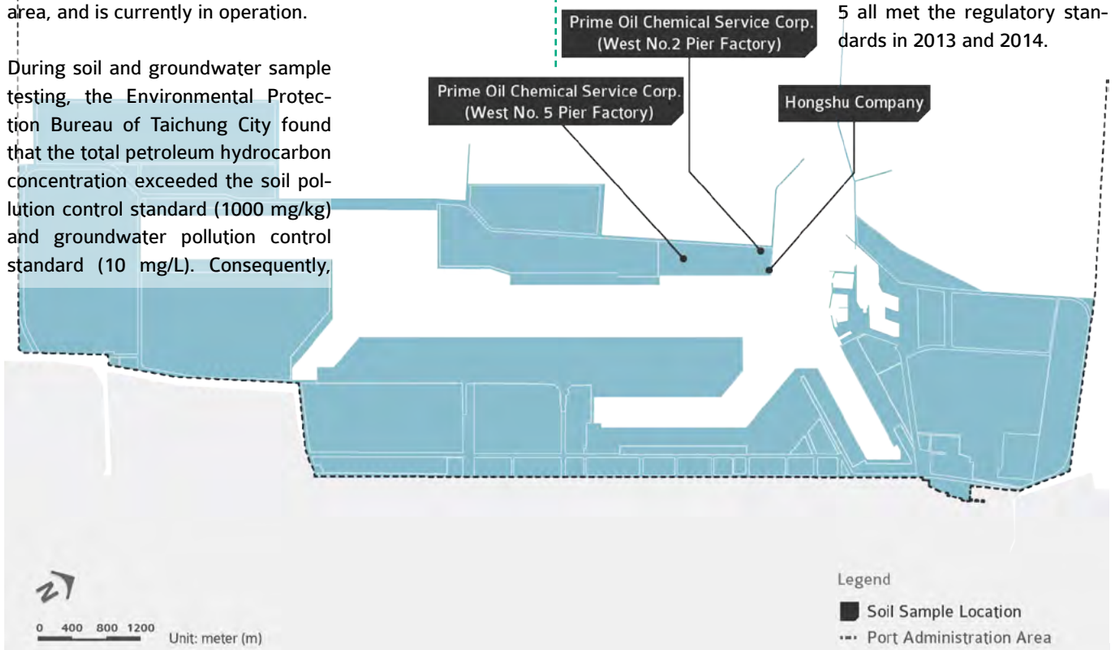
Soil Pollution

The West Terminal area in the Taichung port is distinctive for heavy industry. Therefore, the potential for contamination is relatively high. In response to the Environmental Protection Administration policy, the Environmental Protection Bureau of Taichung City has allocated funds each year for conducting the Taichung City Government Soil and Groundwater Pollution survey and for conducting the Response Measure plan. The bureau also performs random testing on the land inside the port area. If the concentration level of contaminants exceeds the soil and groundwater pollution control standards, the relevant departments are notified to execute appropriate measures and determine those responsible for the pollution.

Over the past 2 years, the Chenergy Global Corporation was required to perform land-pollution monitoring and site improvements in the Taichung port area. The corporation is located at No. 335-18 Gangkou Section, Wuqi District, and occupies a space of 11,636 m². The site serves as an oil storage area, and is currently in operation.

During soil and groundwater sample testing, the Environmental Protection Bureau of Taichung City found that the total petroleum hydrocarbon concentration exceeded the soil pollution control standard (1000 mg/kg) and groundwater pollution control standard (10 mg/L). Consequently, the site was announced as a soil pollution and groundwater pollution control site in 2014 and 2015, respectively, and was designated as a soil and groundwater pollution control zone in the same period. For soil pollution, soil use and human activity are controlled and restricted inside the zone. The Environmental Protection Bureau of Taichung City has recently approved a control scheme. The improvement methods are excavation (i.e., transporting affected soil to a disposal site for heat treatment), chemical oxidation, and biopile remediation. The improvement operations are scheduled to be completed in 4 years. For groundwater pollution, the company will complete the survey tasks and draft a pollution control plan within 6 months in accordance with Article 13 of the Soil and Groundwater Pollution Remediation Act.

For potentially polluted areas, the Port of Taichung, TIPC, installs soil and groundwater monitoring stations every year. According to the monitoring results from the three monitoring stations, the Hongshu Company, Prime Oil Chemical Service Corporation, and the factories of the West piers No. 2 and No. 5 all met the regulatory standards in 2013 and 2014.



» Soil monitoring stations in Taichung Port

» Environmental Performance Indicators of Taichung Port

Significant environmental issues of the Taichung Port	Index item	Calculation method	Index target	Description of calculation 2013	Description of calculation 2014	Corresponding
1. Air quality	Rate of service vessels using shore power	Service vessels using shore power ÷ total number of service vessels × 100%	Shore power for all docking service vessels	18 ÷ 18 × 100% = 100% Number of service vessels: 18; number of shore-powered vessels: 18	18 ÷ 18 × 100% = 100% Number of service vessels: 18; number of shore-powered vessels: 18	Air Quality P.30
	Vessel speed restriction policy	• Number of inbound vessel speed restriction guidance activities held (communication records/work logs) • Number of meetings (through written) invitations for addressing vessel speed restrictions Number of berth meetings addressing vessel speed restriction policies	At least maintain 200 meeting or through written propaganda letter per year	• Number of guidance activities held addressing inbound vessel speed restriction policies (communication records/work logs): since Sept. 12, 2013, hourly messages have been sent to inbound vessels via the automatic identification system (AIS) calling for speeds to be maintained at <12 kn while within 20 M of the port • Number of guidance activities held to address the speed reduction policy: 1 • 77 berth meetings addressing compliance with vessel speed restriction policies were held (berth meetings have been held on every working day since Sept. 12, 2013)	• Number of guidance activities held address the inbound vessel speed restriction policies (communication records/work logs): since Sept. 12, 2013, hourly messages have been sent to inbound vessels via the AIS calling for speeds to be maintained at <12 kn while within 20 M of the port • Number of guidance activities held to address the speed reduction policy: 0251 berth meetings addressing compliance with vessel speed restriction policies were held (berth meetings have been held on every working day since 2014)	
	Completely automated gate control system for all transport operators	• Ratio of vehicle traffic lanes with automated gate controls • Number of trucks and drivers with approved access cards	Number of harbor access lanes equipped with automated gate control: 9 Personal identification (ID) cards issued: 700 per year	To control air pollution, shipping agents, and relevant port and harbor operators are notified at daily berth meetings to reduce the speed of inbound and outbound vessels to 12 kn while within 20 M of the port (addressed each working day since Sept. 12, 2013) Since Sept. 12, 2013, vessel speed restrictions have been also announced automatically each hour to all vessels within 20 M of the port area via the AIS Construction of the AIS speed restriction check system and checking procedures is projected to be completed in 2015	• Ratio of entry lanes equipped with automatic access controls: 7 ÷ 9 × 100% = 77.7% • Ratio of exit lanes equipped with automatic access controls: 8 ÷ 9 × 100% = 88.8% • 7 entry lanes and 8 exit lanes are equipped with automatic access controls • Automatic access control is projected to cover 9 entry lanes and 9 exit lanes • Number of approved personnel RFID access cards: 1288 been approved	
	Ratio of service vessels using low-emission fuels (marine diesel oil or super diesel) ÷ total number of service vessels × 100%	Number of service vessels using low-emission fuels	100% of service vessels using low-emission fuel	100%	100%	Four tugs from the Port of Taichung, TIPC, 4 tugs from TIPC Marine Corporation, and 6 vessels from Ever Comfort Shipping use marine diesel oil; 4 shuttle boats from Ever Comfort Shipping operate on super diesel

» Environmental Performance Indicators of Taichung Port

Significant environmental issues of the Taichung Port	Index item	Calculation method	Index target	Description of calculation		Corresponding
				2013	2014	
2. Port land area development	Maintain harbor green space and green belt areas	Maintain harbor green spaces and green belt areas	Continue maintaining 120 ha of harbor green space	Minimum green belt area maintained: 129 ha(at least reach 120 ha of harbor green space) • 29.9 ha of green space surrounding harbor buildings; 83 ha of harbor green space (mowed); 5.44 ha of landscaped green space at South Central Pier; 10.6 ha in redevelopment zone, dormitory areas, and selected West Terminal locations	Minimum green belt area maintained: 124 ha (at least reach 120 ha of harbor green space) • 29.9 ha of green space surrounding harbor buildings; 78 ha of harbor green space (mowed); 5.44 ha of landscaped green space at South Central Pier; 10.6 ha in the redevelopment zone, dormitory areas, and selected West Terminal locations. Selected Special Zone for Seaside Recreation rentals reduced the mowed green area by 5 ha	Port Landscaping P.46
	Landscape maintenance rate for harbor green areas (number of newly planted woody plants)	Number of newly planted woody plants	25 woody plants added each year (height: >1.5 m)	102 newly planted woody plants • 60 trees surrounding the green space surrounding the harbor building (10 Prunus campanulata, 10 P. incisa, 20 orchid trees, and 20 Tabebuia rosea)42 transplants (12 Podocarpus macrophyllus and 30 Millettia pinnata)	80 newly planted woody plants • 60 trees surrounding the harbor buildings and dormitory areas (20 Koelreuteria elegans, 20 Phanera variegata, and 20 Bauhinia blakeana)20 trees on the harbor roads (10 Terminalia catappa and 10 Calophyllum inophyllum)	
	Areas related to recreational facilities such as waterfront reconstruction and pedestrian-friendly spaces	Areas related to recreational facilities such	Maintain a minimum of 19 ha of land for relevant recreational facilities	Approximately 18.7 ha of relevant recreational facilities • Approximately 2.5 ha of Low Density Development Area • Approximately 0.9 ha of combined space around Pier No.100 and the North Breakwater open fishing area • Approximately 15 ha of land area around the northern scenic road on Huangang North Road • Approximately 0.3 ha of space on the viewing platform on the third floor of the Passenger Terminal	Approximately 19 ha of relevant recreational facilities • Approximately 2.5 ha of Low Density Development Area • Approximately 0.9 ha of combined space at Pier No. 100 and the North Breakwater open fishing area • Approximately 15 ha of land area around the northern scenic road on Huangang North Road • Approximately 0.3 ha of space on the viewing platform on the third floor of the Passenger Terminal • Approximately 0.26 ha of the area extending 1.3 km from Zhongyi Road	
3. Dust emissions	Number of control facilities for handling and stacking	Number of harbor facilities for handling and stacking cargo	At least one set of control facilities added per two year	• 103 handling and control facilities (36 facilities for controlling and handling pollution;18 sets of closed-handling equipment; 2 dust-collection and handling units;16 sets of other equipment (conveyor sprinklers, suction sweepers, and sprayers) • 67 back-end pollution-control stacking facilities: 33 closed indoor warehouses and transit sheds;15 wind fences and barrier walls; and 19 miscellaneous facilities (stacking site sprinkler systems, car wash platforms)	• 105 handling control facilities: 36 facilities for controlling and handling pollution; 18 sets of closed-handling equipment; 2 dust-collecting handling units;16 sets of other equipment (conveyor sprinklers, suction sweepers, and sprayers) • 69 back-end stacking pollution-control stacking facilities: 35 closed indoor warehouses and transit sheds; 15 wind fences and barrier walls; and 19 miscellaneous facilities (stacking site sprinkler systems, car wash platforms)	Air Quality P.30
4. Vessel sewage discharge	Performance of commissioned qualified operators on cleaning oily bilge water	Number of cleanups conducted by relevant vessels ÷ number of vessels that collected oily bilge water × 100%	100% oily bilge water cleanup	45 ÷ 45 × 100% = 100 Cleanups conducted by relevant vessels (oily bilge water): 45 Total oily bilge water collected: 680.74 t (excluding that from service vessels)	27 ÷ 27 × 100% = 100 Cleanups conducted by relevant vessels (oily bilge water): 27 Total oily bilge water collected: 494.1 t (excluding that from service vessels)	Water Quality P.38
5. Harbor water quality	Ratio of certified operators requiring monitoring or operators that own wastewater (sewage) treatment equipment permitted for use in a harbor under the Water Pollution Control Act	Number of certified operators or operators that own wastewater (sewage) treatment equipment permitted for use in a harbor under the Water Pollution Control Act ÷ total number of operators requiring monitoring for generating wastewater (sewage) within the harbor × 100%	Ratio of certified operators requiring monitoring or operators that own wastewater (sewage) treatment equipment permitted for use under the Water Pollution Control Act: 100%	35 ÷ 59 × 100% = 59.3% • Number of certified operators requiring monitoring: 14 • Number of operators that own wastewater (sewage) treatment equipment: 21 • Number of operators within the harbor that generate wastewater (sewage): 59	35 ÷ 59 × 100% = 59.3% • Number of certified operators requiring monitoring: 14 • Number of operators that own wastewater (sewage) treatment equipment:21 • Number of operators within the harbor that generate wastewater (sewage): 59	Water Quality P.38
6. Pollution from river influx	Ratio of river channels or canals installed with trash racks at interception stations	Number of rivers channels or canals installed with trash racks ÷ total number of river channels or canals in the harbor area × 100%	100% of river channels or canals with trash racks installed	3 ÷ 3 × 100% = 100% • Number of river channels with trash racks installed: 3 • Total number of river channels or canals in the harbor area: 3 (i.e., Pier 4: 4-hole rainwater culvert, Pier 19: 8-hole rainwater culvert, and Piers 39 and 40: Wuqi Primary Drain)	3 ÷ 3 × 100% = 100% • Number of river channels with trash racks installed: 3 • Total number of river channels or canals in the harbor area: 3 (i.e., Pier 4: 4-hole rainwater culvert, Pier 19: 8-hole rainwater culvert, and Piers 39 and 40: Wuqi Primary Drain)	
7. Management of harbor basin dredging	Minimum standard for heavy metal sediments: As, Cd, Cr, Cu, Hg, Ni, Pb, and Zn	Heavy metal sediments matching qualifications based on the sediment quality indices in the classification management and usage restriction guidelines (sediment standards for beach nourishment)	Minimum standard:100%	As: 100.00% Cd: 100.00% Cr: 100.00% Cu: 100.00% Hg: 100.00% Ni: N.D. z Pb: 100.00% Zn: 100.00%	As: 100.00%Cd: N. D.Cr: 100.00%Cu: 100.00%Hg: 100.00%Ni: 100.00%Pb: 100.00%Zn: 100.00%	Dredging Management P.42
				Sediment in the Port of Taichung must meet the minimum standards specified by the sediment quality indices in the classification management and usage restriction guidelines for coastal harbor beach nourishment Calculation method for As pass rate: ratio of pass rate according to biannual measurements from each test station Calculation method for Cd pass rate: ratio of pass rate according to biannual measurements from each test station Calculation method for Cr pass rate: ratio of pass rate according to biannual measurements from each test station Calculation method for Cu pass rate: ratio of pass rate according to biannual measurements from each test station Calculation method for Hg pass rate: ratio of pass rate according to biannual measurements from each test station Calculation method for Ni pass rate: ratio of pass rate according to biannual measurements from each test station Calculation method for Pb pass rate: ratio of pass rate according to biannual measurements from each test station Calculation method for Zn pass rate: ratio of pass rate according to biannual measurements from each test station		
8. Hazardous goods management	Number of hazardous goods inspections, relevant emergency response drills, and joint supervised safety drills	Number of hazardous goods inspections, relevant emergency response drills, and jointly supervised safety drills	• Hazardous good inspections per year: 50 • Response drill per year: 1 • Number of jointly supervised drills per year: 2	• 51 hazardous goods inspections • 1 emergency response drill (Maritime Safety Drill No. 7: May 11, 2013) • 2 jointly supervised safety drills (first- and second-half yearly supervised safety drills of 2013)	• 52 hazardous goods inspections • 1 emergency response drill (national ports marine disaster prevention and Taichung ocean pollution response drill: Aug. 12, 2014) • 3 jointly supervised safety drills (including: first-half yearly supervised safety drills of 2014, 2014 safety supervision, site inspections of transport pipelines, and the 2014 Port of Taichung joint inspections for hazardous petrochemical containers and transport pipelines)	Emergency Response P.53
9. Port and harbor waste	General waste removed and recycling rate in the harbor land area	General waste removed from the harbor land area General waste recycling rate in the harbor land area	General harbor waste recycling rate: 100%	Waste removed from the harbor land area: 100% General waste removed from the harbor land area: 686.06 t General waste recycling rate in the harbor land area: 4.94%	Waste removed from the harbor land area: 100% General waste removed from the harbor land area: 641.35 t General waste recycling rate in the harbor land area: 11.32%	Waste and Bilge P.26
	Recycling rate for dredged sediment	Amount of dredged sediment recycled ÷ total amount of dredged sediment × 100%	Dredged sediment recycling rate: 100%	25,228 ÷ 25,228 × 100% = 100% • Recycled dredged sediment: 25,228 m^3 • Total dredged sediment: 25,228 m^3(sand-filling area on the north side of the temporary Northern levee construction road)	2014 dredging project contract pending	Dredging Management P.42
10. Soil pollution	Soil pollution control rate for plant sites within the harbor	Number of controlled plant sites within the harbor ÷ total number of plant sites with contaminated soil within the harbor × 100%	Control rate: 100%	• One controlled plant site within the harbor (Chenergy Company • One plant site with contaminated soil within the harbor (Chenergy Company)	• One plant site under control within the harbor (Chenergy Company) • One plant site with contaminated soil in the harbor (Chenergy Company)	Soil Pollution P.48

Emergency Response

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Environmental Inspection

Ensuring a safe operating environment at Taichung Port is one of the highest priorities of the Port of Taichung, TIPC. The Occupational Safety Division, Harbor Management Division, and Stevedoring and Warehousing Business Division of the Port of Taichung, TIPC send personnel to inspect the aquatic and terrestrial environment of the port area every month on a regular basis. An "Environmental Points System" is used to prevent pollution and to facilitate environmental inspections, and seeks to reward those tenants and companies who have properly managed the port environment. However, when possible pollution is found, the Port of Taichung, TIPC will immediately issue a notice or inform the law enforcement authority to take necessary actions, such as imposing fines. In addition, the company also cooperates with the Environmental Protection Bureau of Taichung City Government and the Maritime and Port Bureau in joint inspection and examination of the port area with regard to port safety and autonomous sewage management.

Unlike other international commercial harbors, Taichung Port has adopted a centralized management system for hazardous materials and petrochemicals at the West Terminal. In addition to the regular patrols of the petroleum storage tanks and transmission pipelines by the Port of Taichung, TIPC, companies at the West Terminal have formed a regional joint-protection organization - the West Terminal Union, which performs regular disaster response drills in conjunction with the Port of Taichung, TIPC, Taichung Harbor Fire Brigade, and other port area management units, such as the fire department. In terms of communication and deployment of equipment in the event of a fire or accident, the establishment of the West Terminal Union has been highly beneficial to safety management at the West Terminal of the Port of Taichung, TIPC.

» Environment inspection statistics for the Port of Taichung, TIPC, 2013-2014

Task/Year	2013	2014
Environmental patrols	305	339
Pollution reporting and checking	50	63
Warning to improve	25	41
Fines based on the Commercial Port Law (by Maritime and Port Bureau)	3	2
Checks by the Environmental Protection Bureau	11	29
Self-management sewage inspection	12	12
Pollution prevention checks (environmental points system)	59	61
Port area safety inspections (with Maritime and Port Bureau)	18	16
Petroleum storage tank and transmission pipe inspections	_	10

» Procedure for reporting major disasters and emergencies at the Port of Taichung, TIPC

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Emergency Notification and Drills

Most accidents occurring in 2013 and 2014 at Taichung Port consisted of small-scale oil leaks, fires and chemical leaks, and secondary hazardous events such as drownings and public safety threats. With regard to environmental issues, the Central Port Affairs Center of the Maritime and Port Bureau issues fines in cases of hazardous events such as dispersal of atmospheric dust particles during cargo handling and vessel oil leaks. As for port pollution and accidents, the Port of Taichung, TIPC and Environmental protection Bureau of Taichung City Government have set up a reporting channel for residents, transportation companies, and other relevant units. In addition, the Port of Taichung, TIPC has also established emergency response plans in the event of marine accidents within the Taichung Port area, as well as different response plans addressing typhoons, floods, earthquakes, tsunami, fire, explosion, ocean contamination, collision of vessels, leakage of toxic chemical substances, general hazards, major flu outbreak, combined hazards, and radiation hazards, and has developed systems for communication and coordination of ship departure and arrival between domestic ports during typhoon periods, terrorist attacks affecting transportation infrastructure, port facility safety threats, and damage to petroleum storage tanks and transmission pipelines.

In addition to managing environmental issues via emergency response measures and various methods for handling reported events, the Port of Taichung, TIPC strives to reduce the incidence hazardous events via occupational safety campaigns, environmental education, and skills training. In addition, joint drills are held every year with other relevant port management units. Between 2013 and 2014, the Port of Taichung, TIPC held three joint drills, which focused on International Ship and Port Facility Security (ISPS), marine accident rescue, and marine oil contamination. The main participating units included the Port of Taichung, TIPC, Taichung Harbor Police Department of the National Police Agency of the Ministry of the Interior, Taichung Harbor Fire Brigade of the National Fire Agency of the Ministry of the Interior, the Central Area Coast Guard Bureau of the of Coast Guard Administration and the Central Port Affairs Center of the Maritime and Port Bureau. As a consequence, port safety and order are maintained through interagency cooperation.

» Number of occurrence of the accident at Taichung Port in 2013-2014

Accident Type / Year	2013	2014
Vessel collisions, foundering, capsizing, fire, oil pollution, and other chemical leaks	3	5
Vessel malfunctions, faulty operation, vessel listing and grounding	4	1
Fire and explosion of major warehouses or storage tanks	0	0
Small-scale pollution in the port, chemical leaks	7	7
Small-scale fires in the port, smoke emissions	6	9
Drowning, accidents, drifting objects on the sea, and others	12	23

» Joint drill records by the Port of Taichung, TIPC in 2013 and 2014

Year	Name of Drill	Drills	Date
2013	Hai-An No. 7 drill	Port safety, International Ship and Port Facility, marine accident rescue, fire extinguishing on vessel, oil pollution prevention, and anti-terrorist action at sea	May 11, 2013
2014	Marine accident and ocean pollution response drill	Vessel fire response, marine accident rescue, and emergency response in the event of ocean pollution	Aug 12, 2014
2014	Port safety, port facility safety, and biological attack drill	Port facility safety drill, ship hijacking prevention exercise, damage prevention exercise, drill for preventing biological attack	Aug 26, 2014

Innovation & Cooperation

06/

The Port of Taichung, TIPC has established best practices for issues concerning the port environment, and the proposal demonstrates the port's ability to successfully promote port environmental management. Between 2013 and 2014, best practices included: (1) creation of an Ecological and Greenbelt Buffer Zone, (2) encouragement of Green Construction, and (3) promotion of Renewable and Green Energy. These three best practices at Taichung Port can be added to the ECO Sustainable Logistic Chain database and provide guidance for other EcoPorts partners.

Port of Taichung Ecology and Greenbelt Buffer Zone

Environmental Management Strategies: Exemplifying, Enforcing, and Enabling

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Concern/Motivation

Port operations and the quality of life in and around the Port of Taichung is effected by the natural environment, which include estuary sedimentation caused by the Dajia River carrying drifting sediments and increased suspended particles in the port during northeast monsoon season. In response to the urgent requirement sand control and land reclamation measures, the Port has planted Casuarinaceae trees along the windward coast of the port area. The trees are cultivated into forest to improve the negative effects of windblown and drifting sand. To improve linking roads and relieve outbound traffic, the Port has reconstructed and widened the north section of Chung 1st Road, Beiti Road, and the peripheral roads on the north side of the windbreaks (Huangang North Road).

Solution

Suppressing Suspended Particles

The Daijia River carries an excessive amount of sand to the Port of Taichung, causing estuary sedimentation. These sands are the main source of drifting sediments flowing into the port. In response, the port has engaged in a number of staged silt regulation procedures along with port construction since 1975. These procedures include the erection of parapets on the outer periphery of the northern silt area, establishment of sand stabilization facilities, and the plantation of over 200,000 Casuarinaceae trees over a 30-hectare area. These procedures not only increased the windbreak forest area, expanded the sand prevention zone, and alleviated the impact of drifting sand, but also contributed to the establishment of the Harbor Park, Banyan Park, and Forest Park. In addition, these procedures helped complete the green spaces surrounding the harbor building, on either side of the Wuqi Drainage Canal, and at the bottom section of Zhongboqu. Subsequently, trees and bushes have continued to be planted in these areas. The land area of the Port of Taichung exceeds 3,000 hectare, comprising roughly 8 hectare of park area, 10 kilometer of green space, 40 kilometer of refuge islands and pedestrian refuges, and 273 hectare of windbreak forest.

Forming Leisure Spaces

The Beiti Road, Huangang North Road, and the north section of Chung 1st Road have been designed as scenic routes. These routes are also designed with comprehensive scenic bicycle paths in compliance with the Taichung City Bicycle Path Development Plan. This path crosses over the water tunnel then merges with the Gaomei Wetlands Bicycle Path, connecting the port's recreational area with the Gaomei Wetlands to create a highly diverse and attractive recreational space. Travelers can use this path to travel between numerous tourist attractions, including the Port of Taichung Passenger Terminal, Chung 2nd Road, Chung 1st Road, Banyan Park, Forest Park, Beiti Road, Wuqi Tourist Seafood Market, Huangang North Road, and the Taipower wind turbines.

The scenic bicycle path of the Port of Taichung manifests an overall length of roughly 11 kilometer. Travelers can visit the Passenger Terminal to enjoy the view of the port area from its viewing platform. Then, they can view a diverse landscape as you travel along the bicycle path, including wind turbines and wetland ecologies. Further along the way, they can discover Tree God and Earth God within the Bayan Park. This area is a popular place of worship by locals during local festivals. Additionally, the Port of Taichung, TIPC established an historical monument in this area in 2012. Considering the overall surrounding environment, the Port of Taichung, TIPC built wind and rain corridors and furnished gazebos to not only cater for locals and tourists, but also strengthening the relations between residents and the port.

Effects/Benefits

The effects/benefits produced by the 11 km port scenic bicycle path constructed by the Port of Taichung, TIPC are as follows:

I. Creating of a green port landscape and imagery that increases attractiveness and international reputation, consequently enhancing marketing effects and competitiveness

II. Increasing ecological functionality of the port's roads and green spaces through ecological engineering in compliance with carbon reduction policies

III. Beautifying port landscape and creating investment incentive for investors

IV. Softening the interface between port and urbanization plans to strengthen ties between the port and its neighboring towns and villages

V. Enhancing the leisure functionality and highlighting the features of the port

VI. Providing port and neighboring residents with location for leisure activities (e.g., jogging and cycling events)

Due to the unique environmental characteristics and frequent draughts during the monsoon season, vegetation struggle to grow in the Port of Taichung. However, based on 30 years of collaboration between the Port and port vendors, the Port of Taichung, TIPC has managed to greenify over 10% of the port land, actuating the Port of Taichung to become a high quality port, achieve its goals of green port development, and elevate international reputation.

In scope of the 273 hectare of underdeveloped land and windbreak forest, if 1000 Casuarinaceae trees were planted per hectare, the Port could purify 18 T of sulfur dioxide, 30 T of nitrogen oxide, and 4.3 T of ozone per year [Note$_1$]. Regarding the direct effect on carbon sequestration, it is estimated that a total of 2,648 T of carbon can be absorbed consistently throughout the year [Note$_2$].

Port of Taichung Ecology and Greenbelt Buffer Zone

Environmental Management Strategies: Exemplifying, Enforcing, and Enabling

Implementation/Timeline

2005: New construction of roads surrounding the port's windbreak forest

2008: Renovation of the green spaces along the port roads (Chung 1st Road, Chungheng 14th Road, Nanheng 1st Road, and Tree God Temple pavement)

2009 to 2013: Plant maintenance and management in port's green spaces

2014: Plantation and maintenance of Casuarinaceae trees in the second-phase remediation area of the port's silt zone.

Environmental Issues

Influence on local communities; port land development; air quality; and fugitive dust prevention

Participants

Taiwan Power Company
Tree God Management Committee

Stakeholders

Taichung citizen, surrounding residents, travelers and visitors

Investment

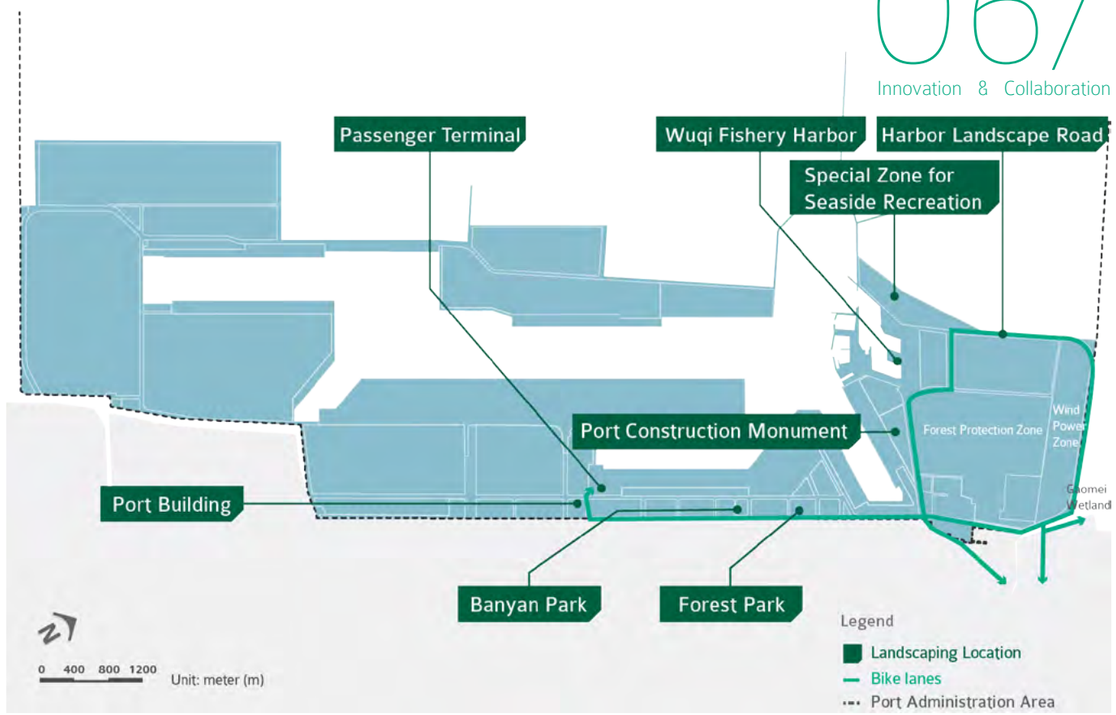
Bicycle path construction along Beiti Road, Huangang North Road, and the north section of Chung 1st Road: Approx. NT$15,000,000

Greenification construction: Approx. NT$5,000,000

Third-phase sand stabilization construction at the north silt zone: Approx. NT$650,000,000

Greenification maintain: Approx. NT$12,000,000/year

Plantation and maintenance of Casuarinaceae trees in the second-phase remediation area of the port's silt zone: Approx. NT$7,000,000/year



Reference Information

Note$_1$: Data were obtained from the Environmental Protection Administration Air Quality Purification Zone website. Calculations were based on a 10 year growth period, 10 m tree length, 103.23 m^2 overall leaf area, and 300 Casuarinaceae trees planted per hectare. Estimations were made on the air pollution quantity of six types of air pollutants, where 20.31 kg of sulfur dioxide, 10561.79 kg of ethylene, 33.11 kg of nitrogen oxide, 4.8 kg of ozone, 39.66 kg of toluene, and 3.66 kg of hydrogen fluoride can be purified per year.

Note$_2$: Calculations were made based on the tree calculated proposed by the Environmental Quality Protection Fund. Parameter included the size (7.5 m), DBH (30 cm), and crown diameter (3.6 m) of Casuarinaceae trees.

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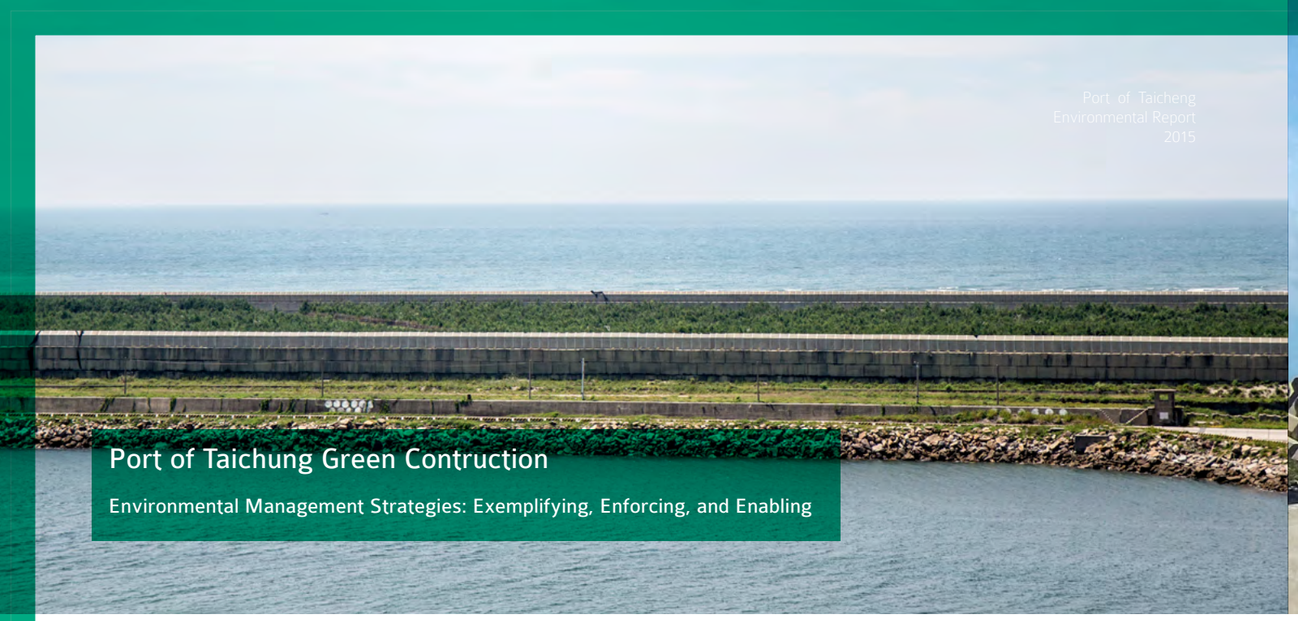
Relevant Websites

Port of Taichung/Green Environment/Port Greenification Performance
http://tc.twport.com.tw/chinese/cp.aspx?n=05AD2BF69D7F8EB0

Air Quality Purification Zone and Green Environment Development Plan
http://ivy1.epa.gov.tw/air/s22.asp

Environmental Quality Protection Fund - Tree Calculator.
http://www.eqpf.org/tree_calculator.html



Port of Taichung Green Contruction

Environmental Management Strategies: Exemplifying, Enforcing, and Enabling

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Concern/Motivation

Under the regulations of government policies, extant national public construction projects are required to employ green construction and green energy products to develop public works that are energy and carbon efficient, and fulfil environment protection responsibilities. Based on government policies, as well as the review results proposed by the Overall Development Plan for Commercial Ports in Taiwan (2012-2016) for development status, port operation zones, operational requirements, and overall planning and layout, the Port of Taichung, TIPC proposed the Quality Port and Green Port Development and Construction Project, which focuses on port infrastructure and operating facilities, such as the piers and public warehouses. Green construction methods and materials are adopted in the Project, where priority is given to construction methods and methods that conserve resources and energy, have low power consumption, reduce waste production, or increase automation.

Solution

The Port of Taichung, TIPC has adopted various green construction methods and materials for development plan (2012-2015) of the port's operation zones. These methods and materials are discussed in the following section:

Green Construction Methods

I. Embankment foundation protection: Soft construction methods, such as the application of sand bags, were used for in situ landfills instead of the traditional outsourcing of materials, such as stone.

II. Old revetment and seawall materials were recycled and reused. The use of local materials reduced outsourcing and transportation costs, as well as pollution derived from such operations.

III. Filling materials for new piers and revetments: These materials were primarily obtained from the neighboring waters of the construction site to reduce the demand for dredging and utilize surplus earthwork.

IV. The waste earthwork produced from dredging navigable waterways in the port area, as well as the grates and concrete paving removed from the bottom section of Beiboqu, were crushed and applied to the seaside embankment protection and beach-nourishment construction operations. This process integrated coastal protection and waste recycling.

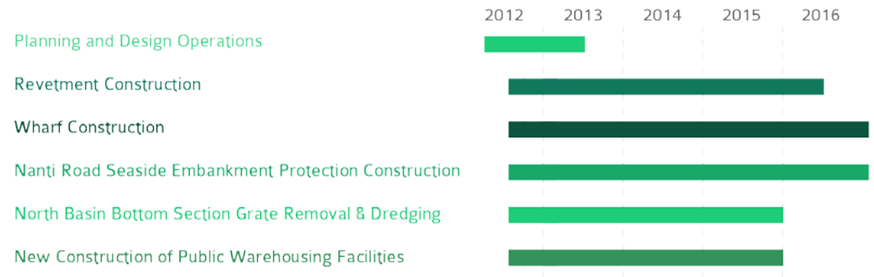
Green Materials

I. Steel: Steel is not only a strong material that can be used sparingly, but also a material that can be recycled and reused.

II. Concrete: Slag from water-quenched blast furnaces was used to substitute a portion of the cement to reduce carbon emission and pollution.

Implementation/Timeline

Based on construction properties and location, a preliminary evaluation of the progress of the contrition plan from 2012 to 2016 was performed.



Effects/Benefits

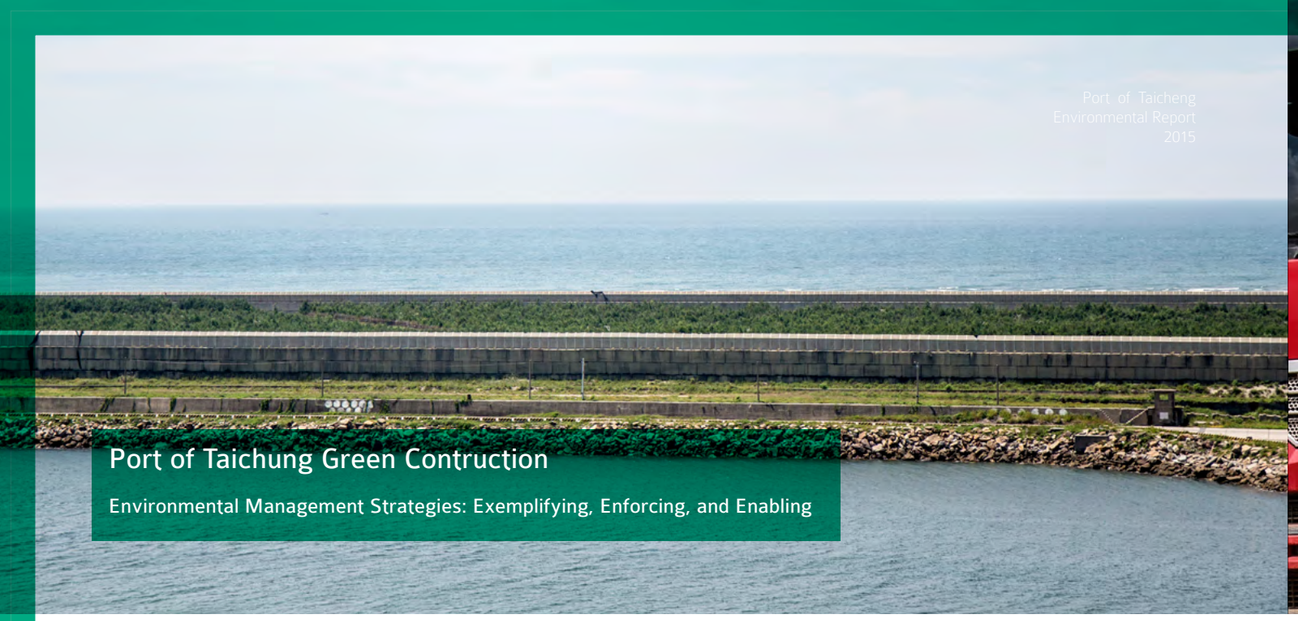
An estimated construction cost of roughly NT$ 325 million can be contributed to energy conservation and carbon reduction, for a total of roughly 10.14% of the direct construction cost. This conformed to the 10% requirement stipulated by the Public Construction Commission.

I. Employing reusable materials: Revetment rubble can be reused as reinforcement for the construction of new revetments; recycled concrete can be used as the core material for the reconstruction of rubble mound breakwaters; and tetrapods can also be recycled, for an overall construction cost reduction of roughly NT$ 63.89 million.

II. Substituting purchased materials with extant materials: Sand bags can be used as temporary containment facilities in place of rubble mount breakwaters, which are produced using the rubble of purchased stone materials, for an overall construction cost reduction of roughly NT$ 1.8 million.

III. Recycling waste: earthwork from the dredging of the inner port can be used as nourishment material for the beach zone (approx. 2.6 million m2) located behind the containment embankment. This process can substitute dumping the earthwork into the ocean, reducing costs by roughly NT$260 million.

Slag from water-quenched blast furnaces was used to replace a portion of the cement required for revetment construction, specifically, cement used in the sheet piles of assembled walls, tetrapods, an caissons. This reduced carbon emissions during construction.



Port of Taichung Green Contruction

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Investment

The overall cost of construction was roughly NT$ 5.927 billion.

Revetment Construction: NT$ 1,507 million.

Pier Construction: NT$ 2,541 million.

Nanti Road Seaside Embankment Protection Construction: NT$ 937 million.

North Basin Bottom Section Grate Removal and Dredging: NT$ 273 million.

New Construction of Public Warehousing Facilities: NT$ 669 million.

Environmental Issues

Port land development; water-relative development; resource depletion

Stakeholders

Forwarders and tenants of the Port of Taichung, and Taichung Export Processin Zone

Participants

Port of Taichung, TIPC

Reference Information

Port of Taichung, 2012. Quality Port and Green Port Development and Construction Project. Taichung: Port of Taichung, TIPC.

Taiwan International Ports Corporation Ltd., 2012. Port of Taichung Future Development and Construction Plan (2012-2016). Taichung: Port of Taichung, TIPC.

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Port of Taichung Renewable and Green Energy

Environmental Management Strategies: Exemplifying, Enforcing, and Enabling

Concern/Motivation

Solar and Wind Power Generation

Energy affects a vast number of dimensions. It is closely related to issue of national security, public demand, economic development, environmental protection, national health, and sustainable development, among many others. In Taiwan, 99% of the energy consumed is exported. Considering the ever-increasing prices of coal, crude oil, and natural gas; the inevitability that such fuels will one day be depleted; and the global warming epidemic caused by the excessive emission of CO_2, renewable energy will inevitably the primary source of energy in the future. This is further complimented by the fact that solar and wind energy are sources that can be independently generated, and they contain little to no carbon, do not require fossil fuel to generate, and are distributable. The Port of Taichung area is extremely suitable for solar and wind generation because of its favorable climatic environment, increased days of sunlight, and scarce surrounding residents.

Public Pier Lighting Remote Control System

Conventional public pier lighting systems are controlled using automatic switches (activated by light), counters set to activate or deactivate at specific times, or manually by port staff. Ports that do not include a flexible and immediate policy in its port standard operating procedures to activate or deactivate its lighting systems often result in the wastage of energy. By implementing a remote control system, the lighting conditions in and around the port can be clearly displayed on a computer, and activation or deactivation commands can be issued remotely, even during automatic switch malfunction. The system enables port staff to control lighting fixtures remotely on the computer, eliminating the requirement to be physically present, thereby saving travel time, fuel consumption, vehicle wear and tear, and power usage, and also increasing work efficiency, management convenience, and lamp life.

Workboat Shore Power

Docked ships typically draw power generated from their engines. To save costs, docked ships often use low-quality fuels to power the generators and satisfy the power requirements of the ship while engaging in dock operations. The low-quality fuels discharge large quantities of particulate pollutants (PM), sulfides (SO_x), nitrogen oxide (NO_x), and carbon dioxide (CO_2) once they are consumed. In addition, the generators generate considerable noise during operations, severely polluting and influencing the peripheral environment of the port area.

Solution

Solar Generation

Port of Taichung draws its solar power from the photovoltaics at the B-C and D-E Water Pools of Taichung Power Plant (Taipower Company), each manifesting a capacity of 614.4 kWp and 1508.64 kWp, respectively. The annual planned generating capacity is 2.25 million kWh. The photovoltaics at the D-E Raw Water Pool are relatively close to the port, separated only by the Longjing Drainage System.

Wind Generation

The Port of Taichung draws its wind power from the windbreak forest zone at the north side of the port and Taichung Power Plant (Taipower Company). The capacity of a single turbine is 2000kW, which translates to a collective generating capacity of 42,000kW. The annual planned generating capacity is 107 million kWh.

Public Pier Lighting Remote Control System

In collaboration with the construction of the primary surveillance system, the Port of Taichung, TIPC established energy-saving lighting systems from Piers No.20 to 31 in 2007 and from Piers No.1-15 in 2009. By using the lines and optical cables of the main monitoring system, signals can be transmitted to the remote host located in the Port Building and the Control and Monitoring Center (Passenger Terminal).

Workboat Shore Power

Eleven Shore Power boxes have been established in the workboat basin area, providing docked boats with power. A low 380/220 V is distributed by the Signal Tower Distribution Room. This power allows docked boats to deactivate their engine generators, thereby reducing the PM, NO_x, and SO_2 air pollutants produced by these generators and improving air quality. Currently, port tugboats are completely reliant on Shore Power when docked in the workboat basin, achieving 100% usage efficiency.

Implementation/Timeline

Solar Generation

The design and construction period was between 2010 and 2014.

Wind Generation

The design and construction period was between 2002 and 2009.

Public Pier Lighting Remote Control System

Energy-saving lighting systems were established on Public Piers 20 to 31 and Piers 1 to 15 along with the construction of the main surveillance system between 2007 and 2009.
Additional systems were established on Public Piers 43, West 1, and West 2 in 2015.

Workboat Shore Power

The design and construction period was 1996.

Port of Taichung Renewable and Green Energy

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Effects/Benefits

Solar Generation

The Photovoltaics at the B, C, D, and E Water Pools in the Taichung Power Plant (Taipower Company) reduces roughly 1,175 metric tons of CO_2 emissions per year.

Wind Generation

Carbon reduction performance: (Calculated using the planned generating capacity) According to the 2013 power-messing factor announced by the Bureau of Energy (0.522 kg - CO_2/kW hour), the wind generation of the Port of Taichung reduces roughly 55,854 metric tons of CO_2 per year.

Tourism performance: The wind turbines operating as the sun sets on the Gaomei Wetlands paints a spectacular picture. This scene has become a popular tourist attraction in recent years, and a favored shoot location for photographers.

Public Pier Lighting Remote Control System

The distance between Piers No.1 to 31 is roughly 9.3 km. Assuming that the lights from Pier No.1 to 31 were manually activated/deactivated once per day, port staff are required to travel 37.2 km from the Passenger Terminal, which translates to 13,578 km/year (365×37.2). If a passenger car were used as the mode of transport, where oil consumption efficiency is 12 km/L of 95 unleaded fuels at NT$26/L, the annual cost of fuel would be roughly NT$30,000 (13,578÷12×26). Subsequently, the distance between Pier West 1 and the intersection of Chungnan 1st Road and Taiwan Boulevard is roughly 15.3 km, which translates to 30.6 km for a return trip and 11,200 km/year (365×30.6). If oil consumption efficiency was 12 km/L of 95 unleaded fuel at NT$26/L, the annual oil consumption would be roughly NT$24,000. Therefore, the installation of energy-saving remote lighting systems at Piers No.1 and 43 can inevitably reduce the wear and tear of vehicles and prolong usage, decrease labor costs, and increase work efficiency.

Workboat Shore Power

According to port statistics, the overall amount of on power consumed by the Workboat Shore Power System between March 2014 and March 2015 was 17,153 kWh. Referencing the carbon emissions statistics of A Study on Port Shore Power System (2011), the Shore Power System effectively reduced 3,431 kg when compared diesel engine generation.

Investment

- Approximately NT$ 3.1 billion was invest in solar generation project.

-Approximately NT$ 1.48 billion was invest in wind generation project.

-Approximately NT$ 53.7 million was invest in established public lighting remote control system.

- Approximately NT$ 1.5 million was expended in the installation of workboat Shore Power equipment.

Environmental Issues

Energy consumption; air quality

Participants

Taipower Company; Port of Taichung, TIPC.

Stakeholders

All citizens; tenants and passengers of the Port of Taichung; visitors of the Gaomei Wetlands; Port of Taichung, TIPC lighting operators; port and ship workers

Reference Information

C. C. Wu, G. D. Yang, and R. Z. Wang, 2011. A Study on Port Shore Power Systems. Taichung: Port of Taichung, TIPC.

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Solar Generation

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Wind Generation

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Public Pier Lighting Remote Control System

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Workboat Shore Power

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Involvement & Collaborating Organizations

The Port of Taichung, TIPC actively cooperates with domestic and foreign companies, governments, and academic institutions in addressing port environmental issues. In addition to gaining an understanding of global development trends, the goal of realizing a green sustainable port is being achieved through collaboration, mutual investment, co-audits, lectures, and internships.

The International Association of Ports and Harbors – Word Ports Conference

The International Association of Ports and Harbors is currently the most influential port and harbor organization in the world, and is a non-governmental organization that provides consulting to various primary UN organizations (ECOSOC, IMO, UNCTAD, UNEP, ILO, WCO, etc.). The Port of Taichung, TIPC participates in the World Ports Conference, which is held once every two years, so as to gain a better understanding of global port development trends.

Association of Taiwan Ports (ATP)

The Association of Taiwan Ports hosted the Cross-Strait Port Development Conference in 2012, and issues such as "Green Transportation and Port Development" were discussed at this Conference.

Association of Pacific Ports(APP)

The Association of Pacific Ports hosts conferences involving industry, government, and educational institutions on a regular basis for the benefit of port management bureaus, port management committees, and other relevant parties. It serves to provide ports in the Pacific region with a platform for exchanging professional skills, management knowledge, and relevant practical experience. The Port of Taichung, TIPC participates in conference on an occasional basis every year and exchanges operation experience with members from other countries so as to gain a better understanding of modern port operations and current development trends at Pacific ports.

Dragon Steel Corporation (DSC)

Performs wastewater recycling and reuse, and provide companies in the port with approximately 3,900 ton of recycled water that can be used for suppressing dust on port piers.

Da-Sheng Transportation Company Ltd.

Dasheng Transportation Company Ltd. adopted the greenery on the south side of Wuqi Boulevard at Taichung Port in 2014, and signed a "Port Vegetated Areas Adoption Contract," which will be effective for the five-year period Jan 1, 2015 and Dec 31, 2019.

An Shun Logistics and Stevedoring Company Ltd. | Chien Shing Harbour Service Co.,Ltd. | San Ho (HK-China) Logistics Ltd.

Taichung Port reserved a piece of land behind the No. 104 dock and cooperated with An Shun to build a closed-type coal warehouse with a capacity of approximately 100,000 MT. The project as a whole included construction of fixed facilities and mobile automated facilities. The project's one-stop handling facilities and pollution prevention equipment can increase coal handling efficiency and prevent pollution of the handling dock. In addition, the HK-China Logistics Company installed closed coal handling machines in 2012. In 2014, Chien Shing built a new closed-type warehouse on a piece of land along the No. 25 dock.

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Feng Chia University

In 2013, the Port of Taichung, TIPC requested Feng Chia University to implement the "Project for Management of the Greenhouse Gas and related Air Pollutants, and Emission Reduction Self-management," which primarily focused on establishing strategies for management and reduction of greenhouse gas and air pollutants emissions at Taichung Port.

Public Trees Management Committees

The Port of Taichung, TIPC and Public Trees Management Committee have cooperated to preserve old trees and objects with cultural and historical value. In 2010, a project for treating and preventing root diseases was launched. A monument was built and rain shades were repaired.

Institute of Transportation, MOTC

The Institute of Transportation has conducted research projects on such subjects as "Congestion Relief," "Capacity Increase," "Expansion and Use of Current Transportation Facilities," and "Establishing a Long Term Transportation Development Plan." In the past, the Port of Taichung, TIPC has worked with the Institute of Transportation on such projects such as "Port Ecological Landscape Planning, Design and Research" and "Energy Conservation and CO_2 Emission Reduction at Taiwan's Ports," etc.

Environment Protection Bureau, Taichung City Government

The Port of Taichung, TIPC and the Environmental Protection Bureau of Taichung City Government have cooperated on audits and drills in the port area on the regular basis and assist the Environmental Protection Bureau of the Executive Yuan in hosting relevant meetings such as the "meeting for discussion of atmospheric dust suppression in central river regions," "public hearing for proposal of air pollution prevention in Taichung City," "public hearing for greenhouse gas emission management and reduction in Taichung city," "drill for atmospheric dust prevention by rivers," "seminar for monitoring, investigation, reporting and control of soil sediments" and "meeting for discussion of regular pollution source control in the Taichung port area."

Central Maritime Affairs Center, Maritime and Port Bureau

The Port of Taichung, TIPC cooperates with the Central Maritime Affairs Center to perform regular audits and drills.
The Port of Taichung, TIPC cooperates with Taichung Harbor Fire Brigade to train personnel in extinguishing fires in offices.

National Cheng Kung University
National Sun Yat-Sen University
National Taiwan Ocean University

In order to enhance international competitiveness and transportation quality, create a sound educational and academic research environment, and allow the port and educational institutions to prosper together, Taiwan International Ports Corporation signed a memorandum of cooperation with three public universities in 2012. In the future, the parties to the memorandum will be involved in academic exchanges, research and development, cooperative undertakings between companies and educational institutions, education and training, student internships, and port operation seminars. In addition to enhancing training quality, the educational institutions involved can also provide intelligence to port affairs companies, and thus play an active role in assisting practical port management and operations, which will achieve a win-win outcome.

Environmental Protection Administration, Executive Yuan

The Port of Taichung, TIPC has participated in the "National Home Cleaning Campaign" implemented by the Environmental Protection Bureau, Executive Yuan by asking port companies to take part in clean-up of the surrounding environment, and regularly maintains and updates the "Website of Eco Life, Home Cleaning, Good Neighbor and Green Life." The Port of Taichung, TIPC also sends personnel to attend forums held by the Environmental Protection Bureau, such as "Central Area Environment Impact Evaluation and Monitoring Seminar," "Conference for Results and Experience of Air Pollution Prevention at Commercial Harbors," "Conference for Discussion of Charges of Air Pollution caused by Ships and Vessels," "Education and Training for Creation of Port Air Pollutant Emission Records," and Discussion Forum for Atmospheric Particulate Matter Improvement Strategies in Central and Southern Taiwan and Air Quality Control in the Central Area.

Forestry Bureau, Council of Agriculture, Executive Yuan

The Forestry Bureau implemented a forest renewal project between 2003 and 2006, and a preliminary coastline forest ecology recovery and afforestation project in 2012. The afforestation area in the Low Density Development Area at the Port of Taichung is 8.1 hectare, and a total of 40,000 Casuarina Trees have been planted. The afforestation area in Special Zone for Industry II is 4.17 hectare, and a total of 20,000 Casuarina Trees have been planted.

Taichung Harbor Fire Brigade

The Port of Taichung, TIPC cooperates with Taichung Harbor Fire Brigade to train fire extinguishing in office places.

Training

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Training

The Port of Taichung, TIPC provides environmental education and training reflecting the company's environmental policies. In addition to increasing awareness of environmental protection, these classes also enhance employees' environmental knowledge, thereby increasing the competitiveness of Taichung Port.

The Port of Taichung, TIPC arranges internal and external training programs every year. In 2013 and 2014, the company arranged 11 and 6 internal and external training programs concerning such environmental issues as ocean pollution and pollution prevention, greenhouse gas management, sewage treatment, occupational health and safety, energy conservation and CO_2 reduction, risk management, energy management system (ISO50001), environmental impact, and other environmental issues.

As for environmental education, the Port of Taichung, TIPC has established an environmental education program based on the "Environmental Education Act." This program requires each employee to attend at least four hours of environmental education per year. During 2013 and 2014, the company arranged 22 and 28 environmental education and training sessions for general employees. More than 300 people participated in these sessions each year.

Type		2013 (person-hours)	2014 (person-hours)
Class topics	Education and the Social Environment	1,319	679
	Climate Change	0	0
	Emergency Rescue	246	222
	Natural Conservation	68	158
	Pollution Prevention	0	0
	Environmental and Resource Management	528	898
	Cultural Preservation	12	0
	Community Participation	0	448
Training Format	Lectures	39	19
	Speech	1,046	890
	Discussion	0	0
	Online Learning	4	2
	Practical Experiments	548	756
	Practice	0	0
	Outdoor Lectures	8	10
	Visits	0	8
	Video	188	264
	Practical Work	248	0
	Activities	92	456

Remarks: Approved Learning=Training Hours x Qualified Attendees

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Communication & Publication

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The Port of Taichung, TIPC communicates relevant information concerning the Port of Taichung to the public via events, workshops, publications, webpages, and exhibitions, which ensures that the general public, terminal operators, academic institutions, and departments of the Port of Taichung, TIPC can have better understanding of the Port.

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Activities

Hai-An No.7 Drill, Ocean Culture, and Activities

The exercise is centered on the subject of "understanding the ocean and ensuring safety." The four exercise activities consist of inspection of army, navy and air force parades, a secret service speed boat drill, and general response at sea. At the same time, cultural activities concerning the ocean were held in conjunction with a Mazu festival. Lion dancing was held and artifacts were exhibited in an ocean culture area set up by Dajia Jenn Lann Temple.

Launch of Green Port Program

This event announced the official development of green ports at seven ports run by Taiwan International Ports Corporation, Ltd., as well as future plans and current achievements of the green port program.

2014 College Green Port Program Contest

Taiwan International Ports Corporation, Ltd. and National Taiwan Ocean University co-organized the "2014 College Green Port Project Contest," expecting to, via the contest, to create linkage among educational institutions, industries, and the general public, and also draw attention to innovative green port ideas. This activity not only allowed the student to understand the current achievements of the green port program, but also enabled enterprises and the general public to gain a better grasp of green environmental issue and promoted green port innovations, thereby inspiring progress in the areas of energy conservation, CO_2 emission reduction and environment ecology.

Seminar / Workshop

Taiwan Green Ports Seminar

The Taiwan Green Ports Seminar exhibited the actual achievements of the green port program at each port, and underscored the TIPC's determination to realize the green port concept.

2014 Green Port Development Conference

Taiwan International Ports Corporation, Ltd. discussed green port development issues from different perspectives and investigated changes and development trends that a green port has to face in conjunction with industry, the government, and academic institutions.

2nd Conference of Port and City Cooperation and Development

The 2nd Conference of Port and City Cooperation and Development focused on "creating new opportunities in port cities," and invited industrial, academic and government units to discuss the four major issues of "cooperation between and development of port cities from the perspective of free trade," "port transitions based on economic cooperation between port cities," "viewing marketing of port cities from the perspective of cruise tourism," and "reconstruction of the port city environment in line with the green port concept."

Publications / Campaign

Significance of Waves – 30-year history of development at Taichung Port

Taichung Port Bureau (the predecessor of the Port of Taichung, TIPC) celebrated the 30th anniversary of Taichung port and published "30-Year Developmental History of Taichung Port"

TIPC Health and Safety Service Manual

The TIPC Health and Safety Service Manual serves as a guidebook for new employees and interns, and provides port occupational safety and health information in order to enhance employee safety awareness.

Port of Taichung, TIPC - Promotional Flyer for Port Occupational Safety, Health, and the Environmental Protection Act

This flyer publicized the "Occupational Health and Safety Act" and other environmental protection acts among companies in port areas, and also created awareness of the "National Home Cleaning Campaign" promoted by the Environmental Protection Bureau of the Executive Yuan by inviting companies in port areas to participate.

Taichung Port Brochure

The Taichung Port brochure contains introduction to the background of Taichung Port, including its geographic location, development goals, and business operations, etc.

Manual of TIPC Port Construction Occupational Safety and Health Audit Practice

The Manual of TIPC Port Construction Occupational Safety and Health Audit Practice serves as a guidebook for employees concerning port construction occupational health and safety audit requirements and management.

Website

Promotion of Taiwan Green Ports (bilingual websites)

Taiwan International Ports Corporation, Ltd. publicizes its green port promotion achievements on this bilingual website, which serves as a channel of communication with the world.

The Global Website of the Port of Taichung, TIPC - Comments

A contact email is provided on the global website of the Port of Taichung, TIPC to allow the general public and consumers to express their opinions.

Global Website of the Port of Taichung, TIPC – Green Environment

The fact that Taichung Port is an artificial port has led to high dust levels in port areas. This is a major problem that the Port of Taichung, TIPC is eager to resolve. On the global website, there is a page specifically concerning the "Port Green Environment," which describes achievements in planting shelterbelts and vegetated areas.

Green Accounting

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Green Accounting

Environmental Investment and Cost

Regarding environmental issues, the Port of Taichung, TIPC has provided funds for environmental maintenance and management, environmental monitoring, environmental planning, publications, emergency response, and communications with the aim of enhancing employees' environmental awareness and environmental maintenance work, improving environmental quality and emergency response capabilities, and increasing the public's understanding of the port. Funds have been provided for the following items:

- Employees: Personnel expenses for environmental control and environmental education and training.
- Environmental maintenance and management: Port green landscaping, waste disposal, and dredging.
- Environmental Monitoring: Monitoring air, noise, water, sediment, and dredging; environmental patrols.
- Environment Planning: Planning of goals and measures for port environmental protection.
- Emergency Response: Accident response expenses, laboratory test fees for materials, and handling of dangerous goods that pollute the port, etc.
- Communication and Publications: Website maintenance, promotional activities and environmental publications.

The total expenditures of the Port of Taichung, TIPC on environmental matters in 2013 and 2014 were NT$ 121,966,101 and NT$ 141,753,713 which were approximately equivalent to € 3,296,381 and € 3,831,181.

» Total expenditures on environmental issues made by the Port of Taichung, TIPC in 2013 and 2014 (Unit: NT$).

Expense items	2013	2014
Personnel	40,810,540	35,755,784
Environmental maintenance and management	72,607,053	91,331,285
Environmental monitoring	5,226,035	10,495,289
Environment planning		2,340,000
Emergency response	395,100	538,545
Communication and publications	2,927,373	1,292,810
Total	121,966,101	141,753,713

Environmental Assets

In order to transform Taichung Port into value-added logistics port in Central Taiwan, a port-dependent industrial area, and an environmentally-friendly green port, the Port of Taichung, TIPC has proposed a series of port development projects (which can be further classified as follow-up projects and new projects) and a general construction and equipment purchasing project. In particular, some projects involving environmental issues, such as construction of new green buildings, increase opportunities for port activities involving the general public, reconstruct dock electrical systems, replace old equipment with new items to increase efficiency, and reduce pollution. The total amounts of environmentally-related fixed asset expenditures made by the Port of Taichung, TIPC in 2013 and 2014 were NT$ 1,356,243,000 and NT$ 1,689,543,000, which are equivalent to approximately € 40,728,018 euros and € 50,737,027.

» Environmentally-related fixed asset expenditures in 2013 (Unit: Thousand in NT$)

Items / Fixed Assets		Land Improvements	Houses and Buildings	Machinery and Equipment	Transportation Equipment	Other Equipment	Total
Development projects	Follow-up Projects	1,081,336					1,081,336
General Construction and Equipment Purchase Project		187,390	24,865	12,278	47,510	2,863	274,907
Total		1,268,726	24,865	12,278	47,510	2,863	1,356,243

2013

»Environmentally-related fixed asset expenditures in 2014 (Unit: Thousand in NT$)

Items / Fixed Assets		Land Improvements	Houses and Buildings	Machinery and Equipment	Transportation Equipment	Other Equipment	Total
Development projects	Follow-up Projects	1,301,850					1,301,850
General Construction and Equipment Purchase Project		220,410	110,577	8,837	44,700	3,170	387,693
Total		1,522,260	110,577	8,837	44,700	3,170	1,689,543

2014

Improvement Recommendations

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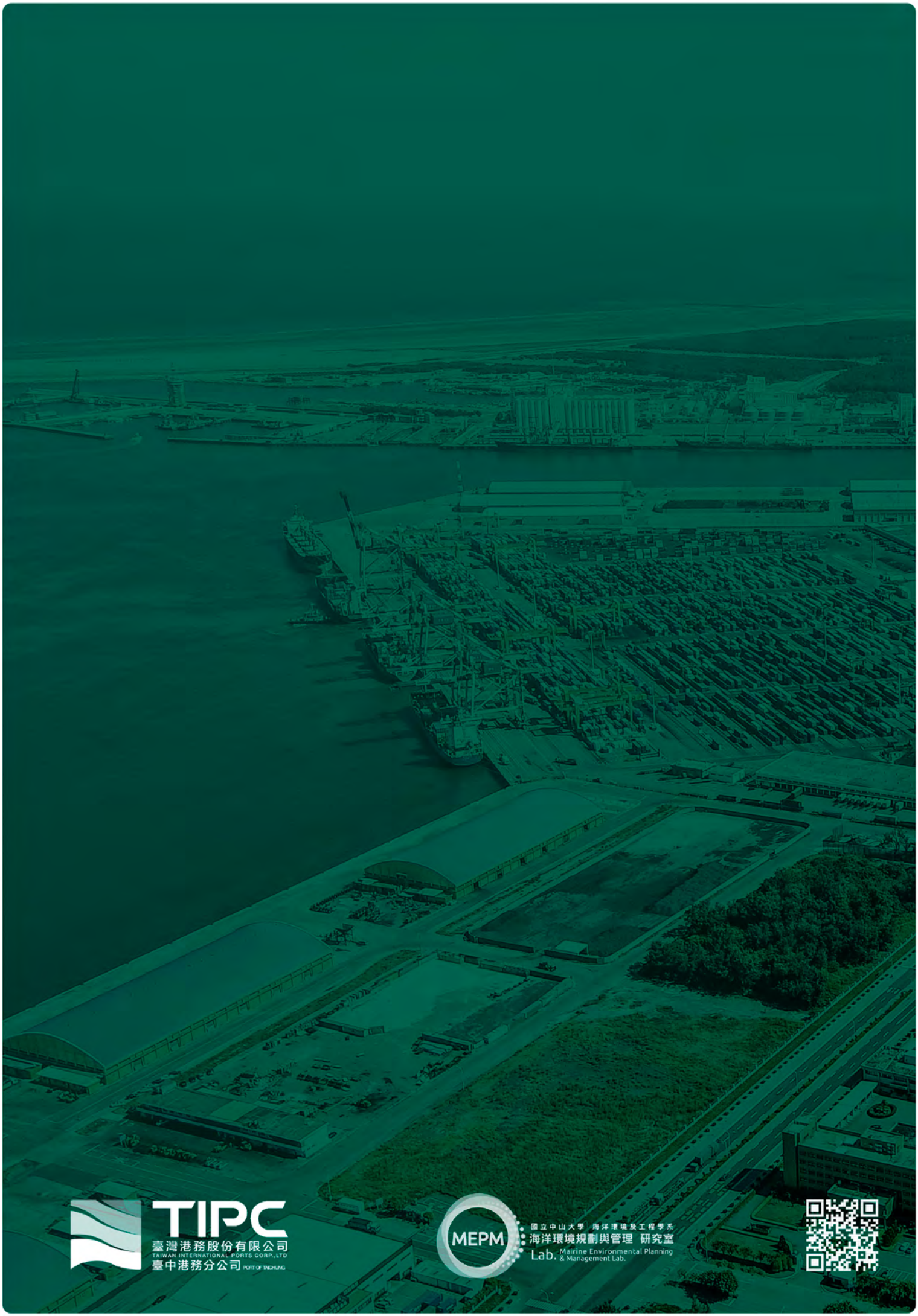
In order to meet the demands of domestic economic growth and changes in marine transportation, construction of infrastructure at Taichung Port has never stopped since the completion of Taichung Port in 1976. After 40 years of development, the port has grown to a considerable size. Our future work will be to make use of existing advantages to maintain Taichung Port's growth while protecting the environment.

In 2012, the port of Taichung, TIPC was transformed into a state enterprise organization. The company seeks to promote a green port policy, and evaluate its green port results from the angle of the four major aspects of "tourism," "cargo operation," "port environment," and "city and community development" in order to effectively quantify port environmental quality. In the future, in addition to enhancing port logistics and creating even greater value, the Port of Taichung, TIPC will also continue to add more functions and actively attract more business to the port in order to enhance its operating performance, create a quality port environment by promoting sustainable eco-development, and build sound relationships with the local governments and companies, which will ultimately achieve a triple-win situation.



TIPC
臺灣港務股份有限公司
TAIWAN INTERNATIONAL PORTS CORP.,LTD
臺中港務分公司 PORT OF TAICHUNG

MEPM
國立中山大學 海洋環境及工程學系
海洋環境規劃與管理 研究室
Lab. Mairine Environmental Planning & Management Lab.