Port of Keelung Environmental Report

▶ 2017

臺灣港務股份有限公司
基隆港務分公司
PORT OF KEELUNG TAIWAN INTERNATIONAL PORTS CORPORATION, LTD

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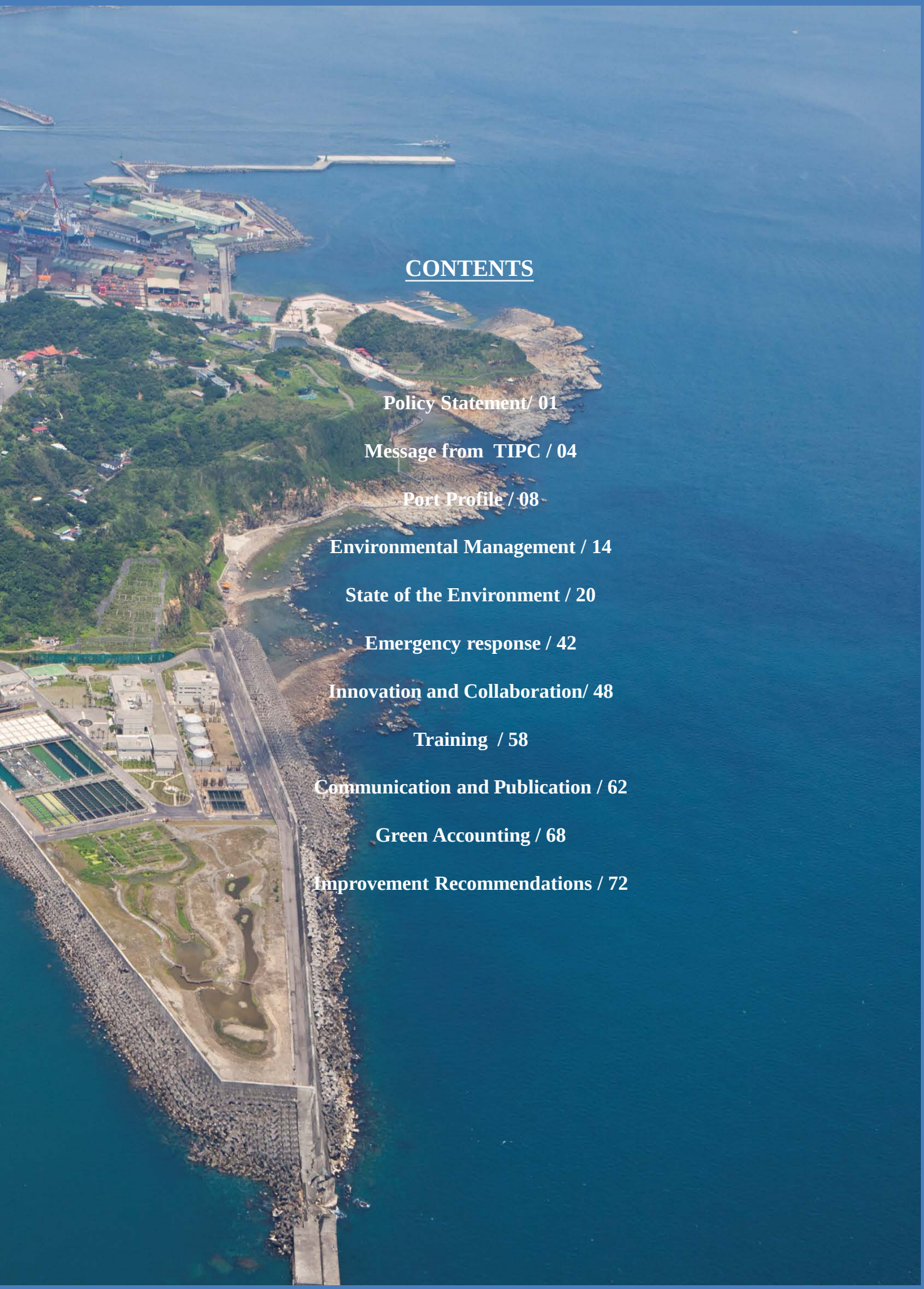
Port of Keelung Environmental Report

This environmental report presents Keelung Port's achievements in environmental protection from 2015 to 2016 as well as the environmental policy, commitments and action plans of the Keelung Port , Taiwan International Ports Corporation, Ltd.

If you have any inquiries regarding this report, please contact us.

Occupational Safety Division, Port of Keelung, TIPC
No. 1 Chung-Cheng Road, Chung-Cheng District, Keelung City 202



CONTENTS

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.

Men-Feng Wu

Men-Feng Wu
Chairman of TIPC
Date: 2016 / 11 / 2

Tien Kuei Kuo

Tien-Kuei Kuo
President of TIPC
Date: 2016 / 11 / 1

臺灣港務股份有限公司
基隆港務分公司
Port of Keelung, Taiwan International Ports Corporation, Ltd.
TIPC

Port of Keelung, Taiwan International Ports Corporation Environmental Policy

In charge of port operation and developments, Port of Keelung, Taiwan International Ports Corporation (hereinafter referred to as Port of Keelung) recognizes its obligations towards protecting the environment as its corporate social responsibility. Aiming at being an eco-friendly and sustainable port with continuous advancement, we consider environmental protection as a part of port operation and work proactively to prevent the pollution of the environmental impacts.

In order to minimize the potential and actual environmental impacts from port operations, Port of Keelung has identified the scope of its environment protection. With autonomous management, periodic inspection and evaluation, we will keep continuously improving our environmental performance.

We commit to:

- Regularly evaluate port environmental impacts and any pollution generated from port operation.
- Set environmental objectives to continuously lower environmental impacts.
- Comply with all relevant environmental regulations and aim at pollution prevention.
- Provide environmental education to build environmental awareness in all staff to completely implement our environmental policy.

The full understanding and mutual consent to this environmental policy have been reached by all the relevant parties, including employees, suppliers and tenants of Port of Keelung. This policy is open to the public on our website.

Shy-tzong Liou

President of Port of Keelung, TIPC

Date: Feb. 13, 2017

No.1, Chung-Cheng Road, Keelung 20202, Taiwan, R.O.C.
Tel:(02)24206100 Website: http://kl.twport.com.tw/

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基隆港務分公司
PORT OF KEELUNG TAIWAN INTERNATIONAL PORTS CORPORATION, LTD

Port of Keelung Environmental Objectives

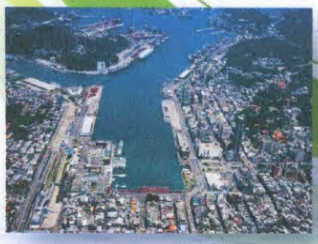
To implement the commitments of Keelung Port environmental policy, the following environmental objectives are set based on the ten major environmental issues from the port.

- **Improve Port Air Quality-replace old equipment with energy saving equipment and plan for gradual automatization of the container handling terminal**
- **Reduce Port-generated waste-promote waste reduction in the port area and the recycling and reuse of resources**
- **Reduce Noise-develop a port access system and continue to operate the automated and continuous port environment monitoring system**
- **Reduce River Pollution-develop plans for a waste water interception facility to propose to the municipal government to safeguard water recreation areas in the port area**
- **Strengthen Hazardous Cargo Management-advise container freight station managers to develop and implement dangerous goods storage management plans**
- **Abate Ship Exhaust - promote vessel speed reduction and the use of cleaner fuel by ships**
- **Reduce Vessel Sewage Discharge-enforce appropriate waste oil and sewage disposal by ships and conduct joint inspections with law enforcement units**
- **Reduce Cargo Spillage-improve cargo handling management, prevent overloading and leakage, and strengthen the emergency response mechanism**
- **Regulate Vehicle Transport- create and promote an automatic port gate system and autonomously assist the Environmental Protection Bureau in controlling old trucks**
- **Enhance Port Water Quality-gradually connect the port waste water to the public sewage system and monitor water quality of the port area**

The President, Port of Keelung, TIPC is responsible for the implementation, maintenance and communication of the environmental objectives, and also for reviews the environmental objectives on an biennial basis and adjusts the action plans based on the condition of the Port, so as to live up to the promises and improvements to achieve the environmental objectives.

President of Port of Keelung, TIPC: Shy-tzong Liau

Date: July 25, 2017



Message from TIPC

01/

Message from the Chairman of Taiwan International Ports Corporation ,Ltd

The Taiwan International Ports Corporation, Ltd. (TIPC) is committed to advancing port infrastructure, improving facility and service, optimizing land use and preventing pollution. In recent years, we have been networking with global ports and active in international certification schemes of port environment management. The environmental performance of ports in Taiwan is thus recognized by the world. With our global presence, we are well positioned to achieve our goal as building Ecoport and Green Port.

Sustainable development has been the foundation on which the TIPC has been built. It is our strong belief that long-term operation and success are not possible without social, economic and environmental prosperity. We are dedicated to carrying out our mission of creating the best investment environment for the port business as well as the livable life for the neighboring communities.

At the TIPC, we will continue the collaboration and communication with shipping companies, port business, neighboring communities and local governments. Together with public authorities and citizens, we will seek ways to build ideal international green ports for all.

Men Feng Wu

Meng-Feng Wu
Chairman
Taiwan International Ports Corporation, Ltd.

Message from the President of Taiwan International Ports Corporation ,Ltd

Changes in the global climate and the quality of the marine environment have contributed to a wide attention on pollutions created during ship operations as well as greenhouse gas emissions produced during international shipping. As one of the world's most advanced port operators, the Taiwan International Ports Corporation, Ltd. (TIPC) takes into account climate risks when designing its port facilities. Moreover, we actively establish environmental management system and enable public access to port-related environmental information.

Environmental policy is the guiding principle of environmental management in our ports. We work toward minimization of the negative impact on port environment during port operations and development. As of today, the Ports of Kaohsiung, Keelung, Taichung, Hualien and Taipei have received the EcoPort certification of the European Sea Ports Organization.. The Ports of Hualien and Taipei are planning to implement such certification system this year and thus joining the global network of EcoPort.

As a transportation hub in the Asia-Pacific region, Taiwan ports shoulder the responsibility of promoting international trade and shipping development. TIPC will continue to provide the shipping industry with high-quality services so that ports and the local cities coexist in harmony and work jointly to facilitate mutual developments. Such partnership will allow the ports to continue to innovate and will improve our competitiveness. Now and in the future, all of our staff members will work diligently to protect the environment and ensure sustainable port development.

Tien Kuei Kuo

President
Taiwan International Ports Corporation, Ltd.

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

Operators of international ports are seeking to achieve a balance between economic development and environmental protection as their ports continue to develop. Port authorities increasingly emphasize going "green" and becoming "sustainable." Against this backdrop, the TIPC oversees the implementation of ecofriendly initiatives at all ports across Taiwan, thereby maximizing its corporate social responsibility efforts and cementing its corporate image.

Port of Keelung functions as a container terminal for ships that operate in near-sea shipping lines, hosts passenger and cargo vessels that travel between Taiwan and China, and foreign cruise liners. The port boasts its position as the Asia-Pacific hub of logistics distribution. The administration of the port continues to maintain stable growth in terms of profitability, and also strives to maintain the port environment, control pollution within the port, and strengthen its relationship with the local community in a manner that contributes to the sustainability of the port.

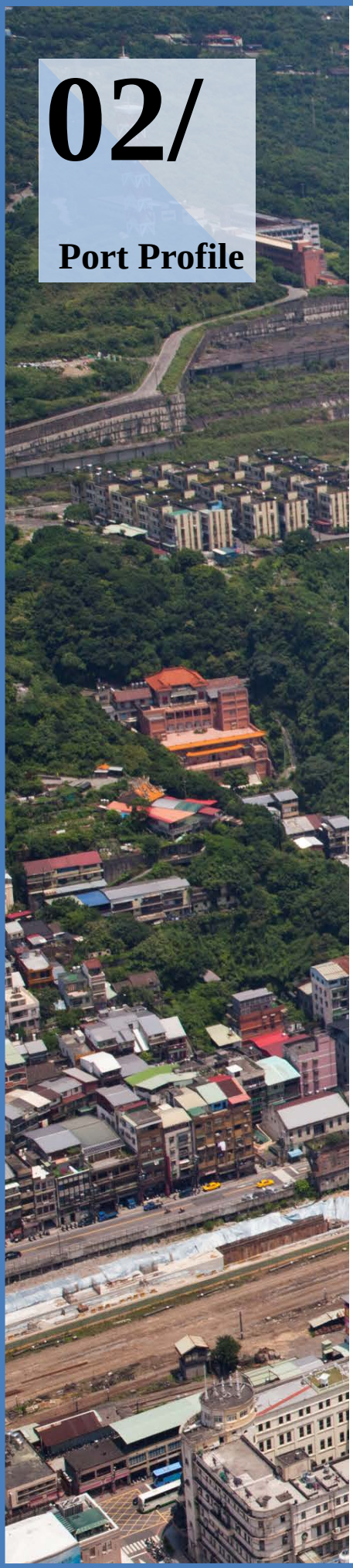
Port of Keelung endeavors to reduce the environmental impact of operations within the port, cement its relationship with the residents of Keelung City, maintain its EcoPort status, engage with partners across the world, and rejuvenate the port city of Keelung through benchmarking strategies.

Shy-tzong Liau

President
Keelung Branch of TIPC

Port Profile

02/



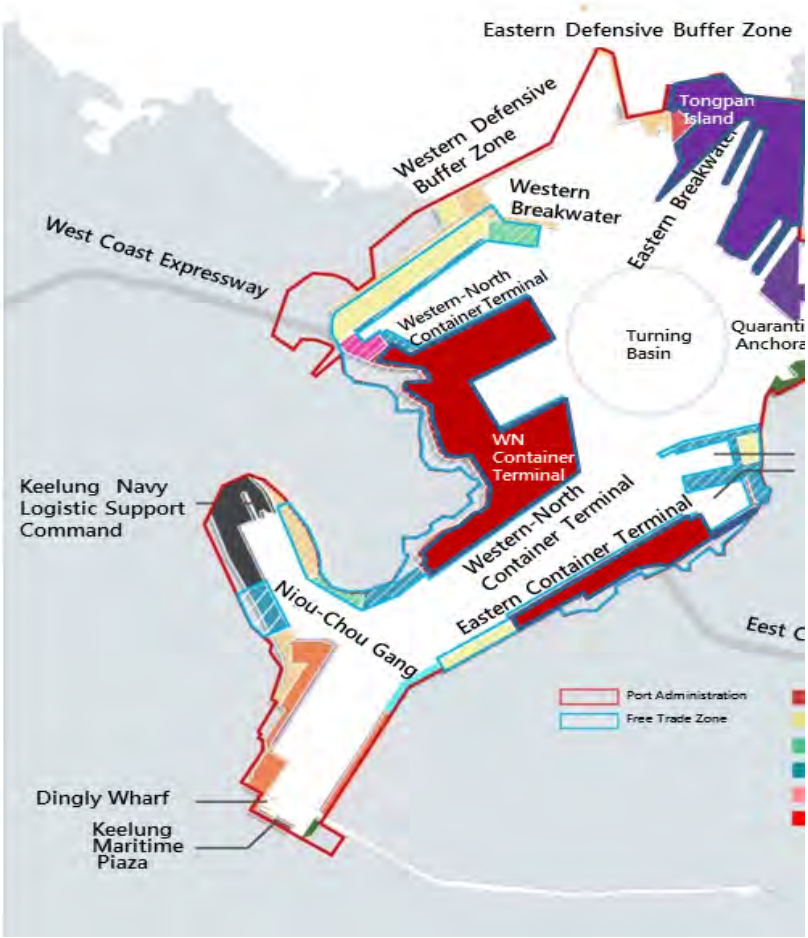
02/ Port Profile

Port Location and Port Area

Port of Keelung is located in the Northeastern tip of Taiwan (121˚44'22.5" and 25˚09'26.5" north latitude) and is the primary shipping hub in Northern Taiwan. The harbor includes a total of area 5,721,657.57 square meters (572.17hectare). The land area accounts for 196.4 hectares while the marine area accounts for approximately 375.8 hectares. The dock has a design depth between 3.0 to 15 meters and has a tidal range of 0.73 meters. The port has only one entrance.

Geographically, Keelung Port's stevedoring advantages were naturally formed, and the port is a rare natural port. The seashore around Keelung Port is primarily composed of pebble beaches, rocky shores, and seawall. The port itself is in close proximity to Keelung City, industrial areas (CSBC Keelung shipyard, Hsieh-ho Power Plant), and leisure and recreation areas. The mouth of two major rivers, the Hsu-Chuan River and Tien-Liao River are located in the port area.

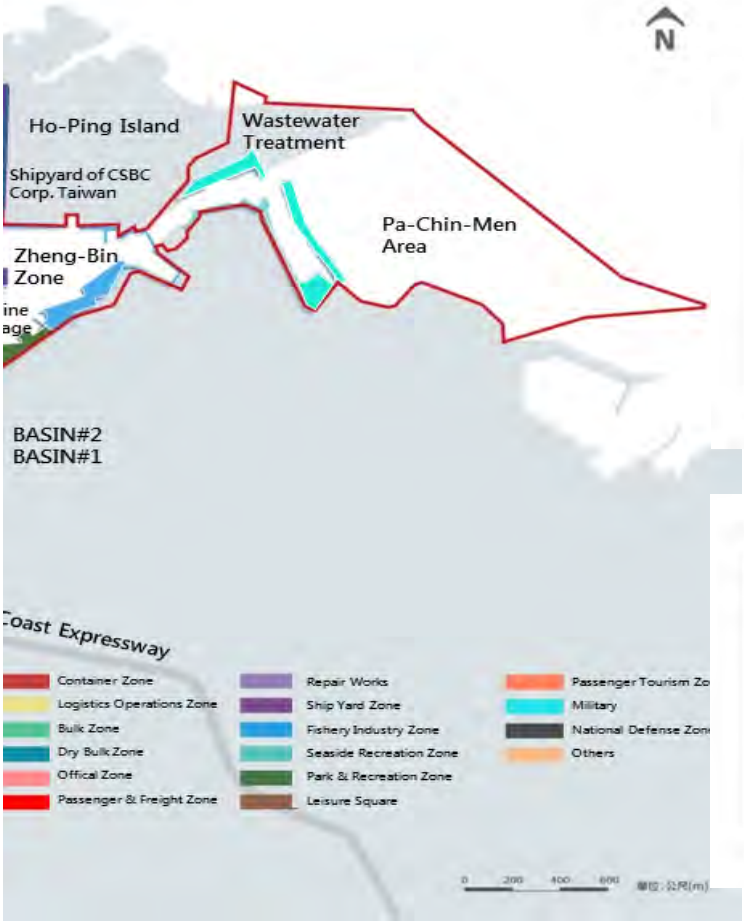
>>Master Plan of Port of Keelung

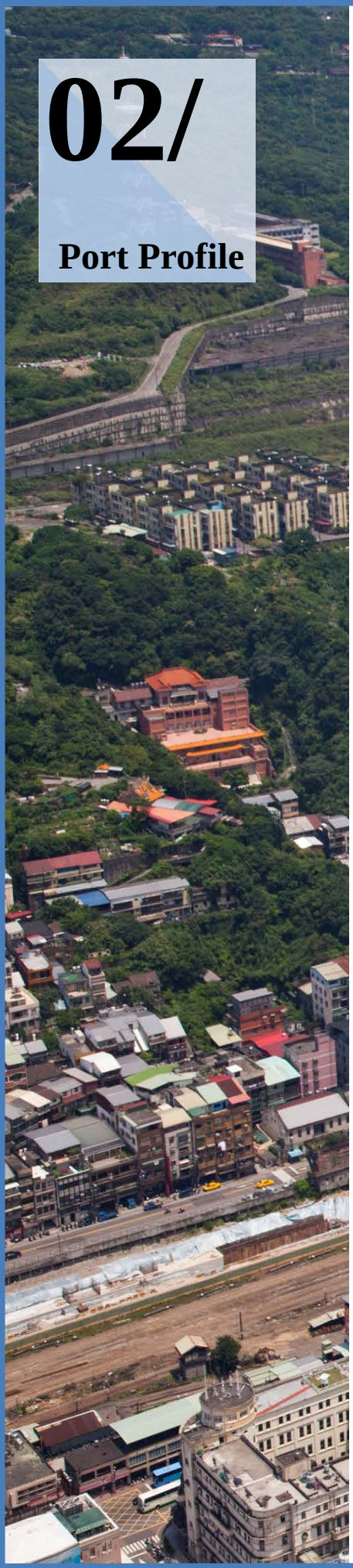


Legal Status and Port Operators

To promote modernized commercial port management system reforms, The Taiwan International Ports Corporation, Ltd. Establishment Act was promulgated on November 9, 2011, 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 Keelung Port Bureau, Taichung Harbor Bureau, Kaohsiung Harbor Bureau, and Hualien Harbor Bureau into a company managed system (T I PC).

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 Keelung Port Bureau, stevedore operation business is now the responsibility of the Port of Keelung, TIPC. Maritime administration, operation items, and public authority within the harbor are handled by the North Taiwan Maritime Affairs Center of the Maritime and Port Bureau.





02/ Port Profile

Commercial Activities

Keelung Port's commercial harbor area has 56 docks, 20 on the east shore and 36 on the west shore. dock types include 15 container docks, 19 bulk cargo docks, and 6 passenger docks. Transported cargo is mainly containers, followed by bulk cargo, then automobiles, yachts, steel, cement, coal, and petroleum goods. Commercial activities within the harbor include ship building and repair, yacht dock, leisure and recreation, and general manufacturing.

>>Main Commercial Activities and Cargo Handling of Port of Keelung

Commercial activities	
Aggregates (sand and gravel)	Ship building and maintenance
Yacht dock/leisure	Storage and packaging
Cargo stevedoring	
Dry bulk cargo	Liquid bulk cargo (non-petroleum)
Automobile	Petroleum
Ro-Ro	General cargo

>>Keelung Port business statistics from 2015 to 2016

Business item	
Incoming and outgoing ships	Total number of ships (vessel)
	Total tonnage (ton)
Cargo stevedoring quantity	Total (shipping ton)
Container stevedoring quantity	Total (TEU)
Cargo throughput	Imported cargo (metric ton)
	Exported cargo (metric ton)
	Domestic cargo (metric ton)
	Total (metric ton)
Number of travelers	Total number of travelers (number of people)

Main Cargoes

The main import cargo at Keelung Port for 2015 and 2016 was mineral products, followed by base metal products ,and chemical or industrial products. Main export cargo was plastic and rubber products, chemical and industrial products, and textile products.

>>2015-2016 Main import cargoes of Port of Keelung

Type(ton)	2015	2016	Comparison between 2015 and 2016	
			Difference	%
Mineral Products	5,263,338	4,194,117	-1,069,221	-20.3%
Base Metals and Articles of Base Metal	1,399,397	1,279,449	-119,948	-8.6%
Products of the Chemical or Allied Industries	1,330,983	1,395,445	64,462	+4.8%

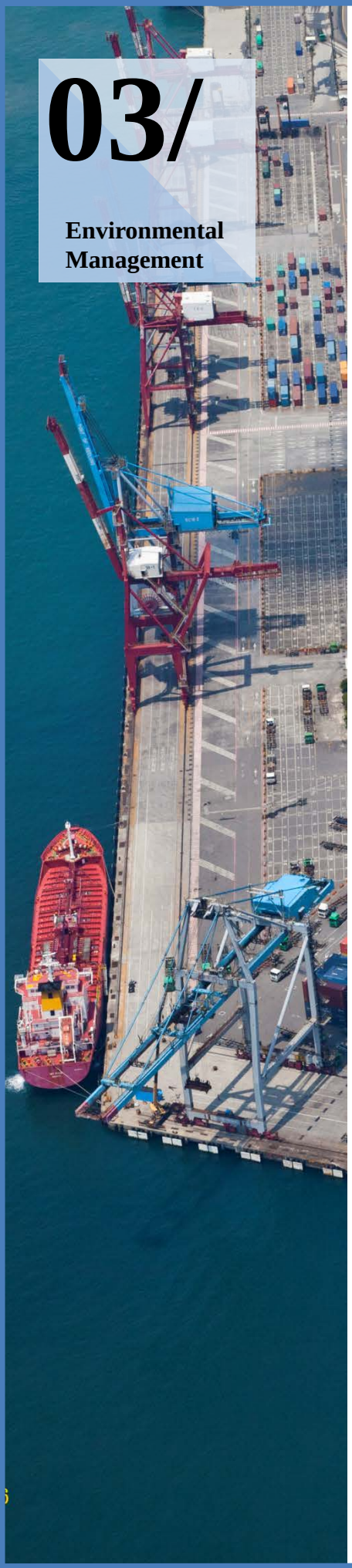
>> 2015-2016 Main export cargoes of Port of Keelung

Type(ton)	2015	2016	Comparison between 2015 and 2016	
			Difference	%
Plastics , Rubber and the Products thereof	995,786	914,512	-81,274	-8.2%
Products of the Chemical or Allied Industries	616,597	530,985	-85,612	-13.9%
Textiles and Textile Articles	513,106	438,026	-75,080	-14.6%

2015	2016	Comparison between 2015 and 2016	
		Actual number	%
11,839	11,466	-373	-3.15
193,275,419	187,500,516	-5,774,903	-2.99
62,478,862	58,621,984	-3,856,878	-6.17
1,445,337.25	1,388,104.75	-57,232.50	-3.96
11,452,829	10,224,339	-1,228,490	-10.73
3,802,845	3,311,380	-491,465	-12.92
4,110,950	3,688,525	-422,425	-10.28
19,366,624	17,224,244	-2,142,380	-11.06
693,956	782,134	88,178	12.71

Environmental Management

03/



03/

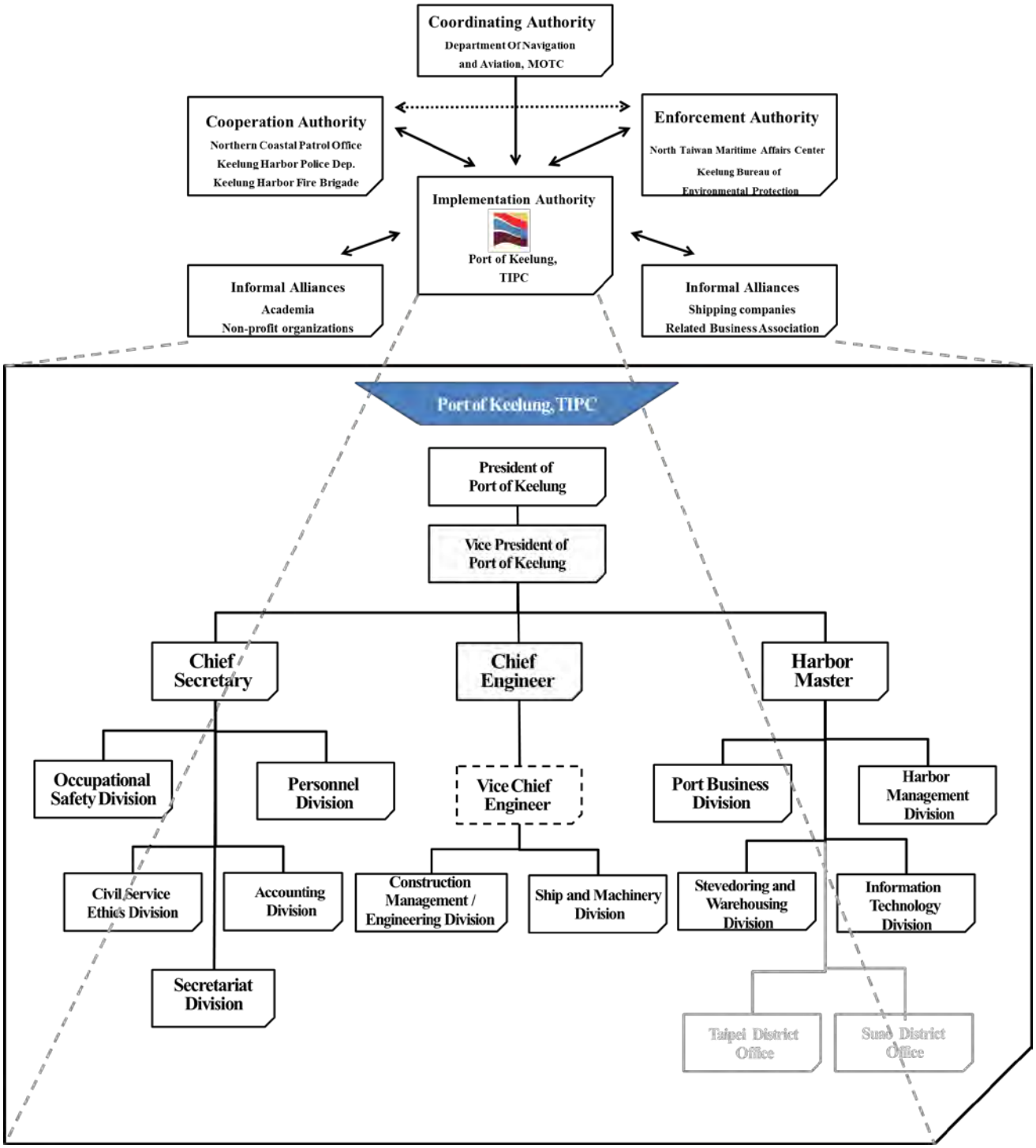
Environmental Management

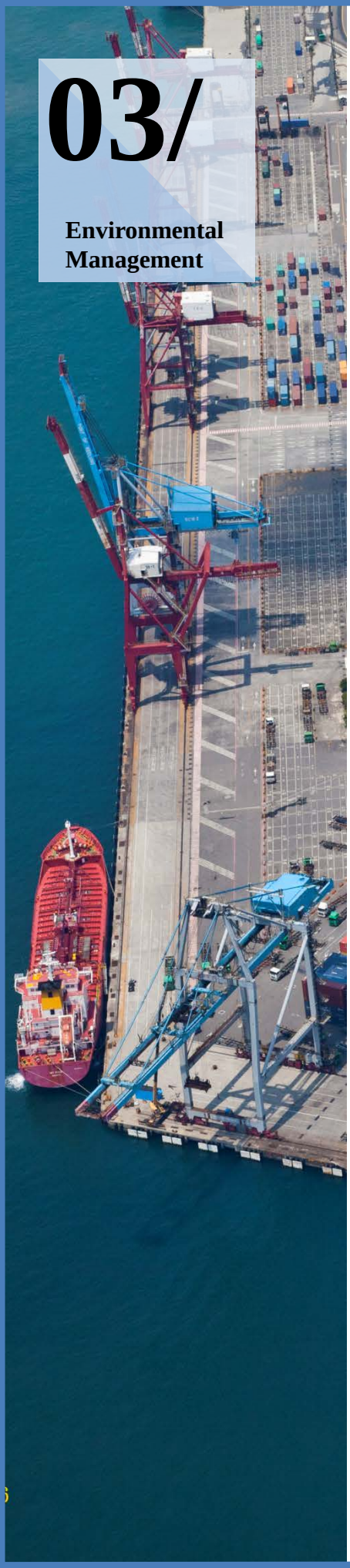
Organization Structure

In addition to the Port of Keelung, TIPC, environmental issues within the Keelung Port also involves the North Taiwan Maritime Affairs Center of the Maritime and Port Bureau (MPB) (Ministry of Transportation and Communications), the Department of Economic Affairs (Keelung City Government), the Bureau of Environmental Protection (Keelung City), the Environmental Protection Administration (Executive Yuan), the Coastal Patrol Directorate General - Northern Coastal Patrol Office of the Coast Guard Administration (Executive Yuan), the Keelung Harbor Police Department (National Police Agency, Ministry of the Interior), the Keelung Harbor Fire Brigade (National Fire Agency, Ministry of the Interior), the Navy Keelung Logistics Support Command, the Keelung Customs (Customs Administration, Ministry of Finance), and the Centers for Disease Control Taipei Area Control Center - Keelung Office.

The Port of Keelung, TIPC has 13 internal divisions, functions of the divisions of the Port of Keelung as follow:

Division	Description
Secretariat	Company Management
Construction Management / Engineering Division	Port planning, design, construction and supervision
Harbor Management Division	Port safety management and port affairs management
Stevedoring and Warehousing Business Division	Tourist services and private store operation
Port Business Division	Attraction of local investments, 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
Occupational Safety Division	Port environmental protection, pollution prevention and management of occupational health and safety
Civil Service Ethics Division	Enforcement of ethics and investigation
Taipei Port Branch Office of Keelung Port, TIPC	Taipei port operation and management
Suao Port Branch Office of Keelung Port, TIPC	Suao port operation and management


Coordinating Authority
Department Of Navigation and Aviation, MOTC
Cooperation Authority
Northern Coastal Patrol Office
Keelung Harbor Police Dep.
Keelung Harbor Fire Brigade
Enforcement Authority
North Taiwan Maritime Affairs Center
Keelung Bureau of Environmental Protection
Implementation Authority
Port of Keelung, TIPC
Informal Alliances
Academia
Non-profit organizations
Informal Alliances
Shipping companies
Related Business Association
Port of Keelung, TIPC
President of Port of Keelung
Vice President of Port of Keelung
Chief Secretary
Chief Engineer
Harbor Master
Occupational Safety Division
Personnel Division
Vice Chief Engineer
Port Business Division
Harbor Management Division
Civil Service Ethics Division
Accounting Division
Construction Management / Engineering Division
Ship and Machinery Division
Stevedoring and Warehousing Division
Information Technology Division
Secretariat Division
Taipei District Office
Suao District Office



03/

Environmental Management

Relevant International Regulations

The Keelung Port follows relevant international specifications, such as International Convention for the Prevention of Pollution From Ships (MARPOL 73 /78), London Dumping Convention, International Convention on the Control of Harmful Anti-fouling Systems on Ships etc.

	Laws Title
Sectors in the Ministry of transportation and communications	The Commercial Port Law
	The Law Of Ships
	Shipping Act
	Act for the Establishment and Management of Free trade zones
Sectors related to agricultural	Wildlife Conservation Act
Sectors in the Ministry of the Interior	Fire Services Act
Sectors related to environmental protection	Basic Environment Act
	Marine Pollution Control Act
	Air Pollution Control Act
	Toxic Chemical Substances Control Act
	Indoor Air Quality
	Water Pollution Control Act
	Waste Disposal Act
	Soil and Groundwater Pollution Remediation Act
	Noise Control Act
	Environmental Impact Assessment Act
	Resource Recycling Act
	Greenhouse Gas Reduction and Management Act
	Environmental Education Act
	Public Nuisance Dispute Mediation Act
Intersectoral	Disaster Prevention and Protection Act

In addition to the international environmental specifications and conventions, the Keelung Port collaborates with local authorities to manage the environment in the Port in compliance with relevant environmental laws and regulations in Taiwan. The follow table lists the relevant environmental laws and regulations related to ports in Taiwan.

	Central Competent Authority	Local Law Enforcement Agencies
2011/12/28	Ministry of Transportation and Communications	North Maritime Affairs Center, Maritime and Port Bureau, MOTC
2010/12/08		
2014/01/22		
2012/12/28		
2013/01/23	Council of Agriculture	Department of Economic Affairs, Keelung City Government
2017/01/18	Ministry of the Interior	Keelung City Fire Department
		Keelung Harbor Fire Brigade
2002/12/11	Environmental Protection Administration	Environmental Protection Bureau, Keelung City Government
2014/06/04		
2012/12/19		
2013/12/11		
2011/11/23		
2016/12/07		
2017/06/14		
2010/02/03		
2008/12/03		
2003/01/08		
2009/01/21		
2015/07/01		
2010/06/05		
2009/06/17		Public Nuisance Disputes Mediation Committee, Keelung City Government
2016/04/13	Ministry of the Interior	Keelung City Government

State of the Environment

04/

04/

State of the Environment

Air Quality

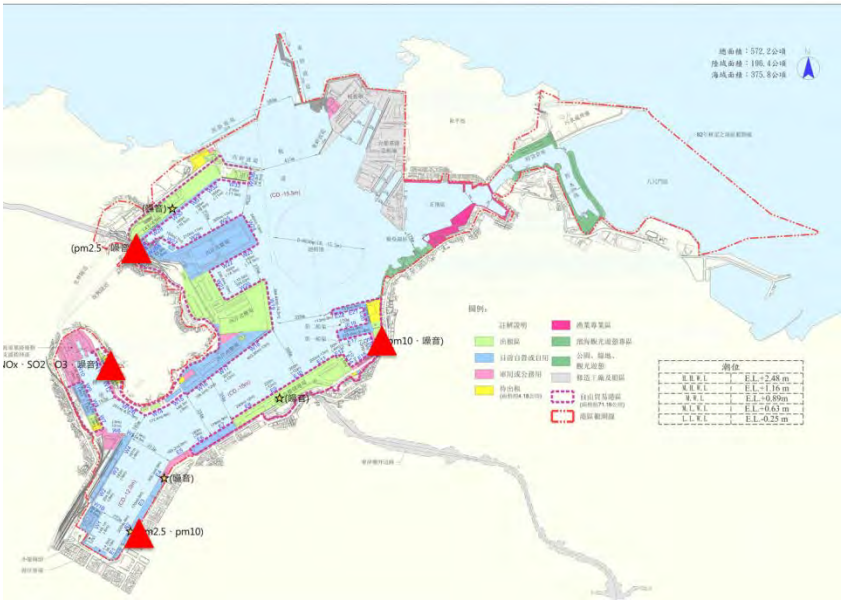
The major sources of air pollution at the Keelung Port comprise vessel emissions, vehicle exhausts, dust emissions, and smokestack emissions from the nearby Hsieh-ho Power Plant. To improve the air quality in the port and harbor areas, the Port of Keelung, TIPC, is assisting the EPA in restricting the use of aging trucks and promoting the use of alternative fuels to reduce exhaust emissions.

The monitoring items include particulate matters (PM_{10}), fine suspended particles ($PM_{2.5}$), sulfur dioxides (SO_2), ozone (O_3), nitrogen oxide (NO), nitrogen dioxide (NO_2), and wind speed etc.

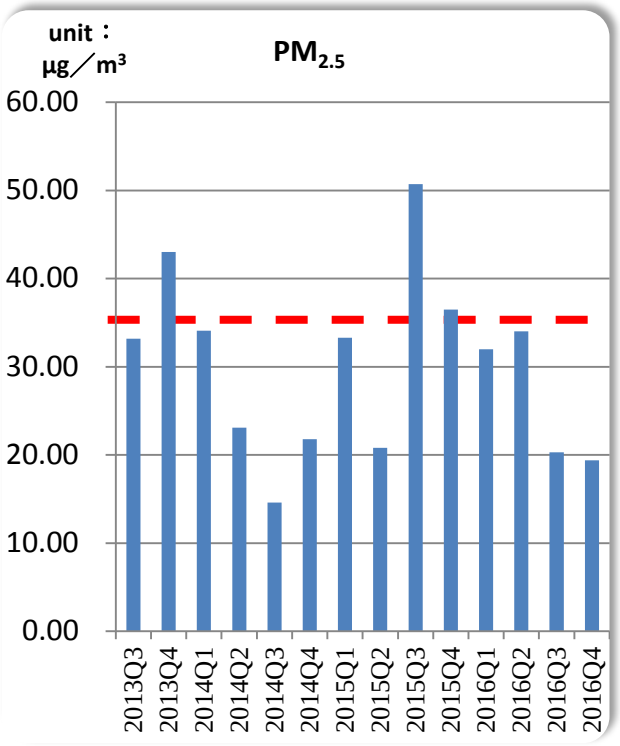
The air quality measurements are all meeting the Air Quality Standards in 2015. Under the influence of northeast monsoons, $PM_{2.5}$ increase during winter in 2016 and qualification rate of air quality is 82%.

Replace 4 sets of diesel straddle carriers , establish electric rail-mounted gantry cranes to reduce exhaust emissions by 54.6%

>>Air Quality Monitoring Stations and Sites



▲ Port Monitoring Station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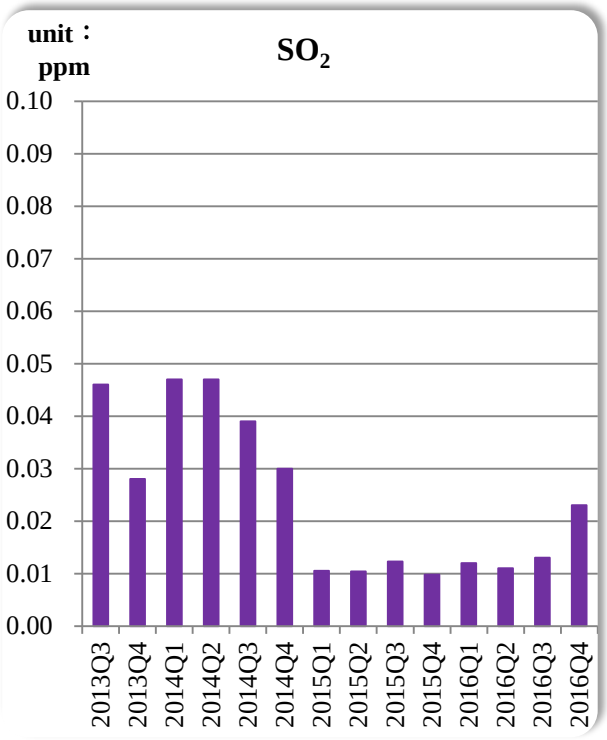
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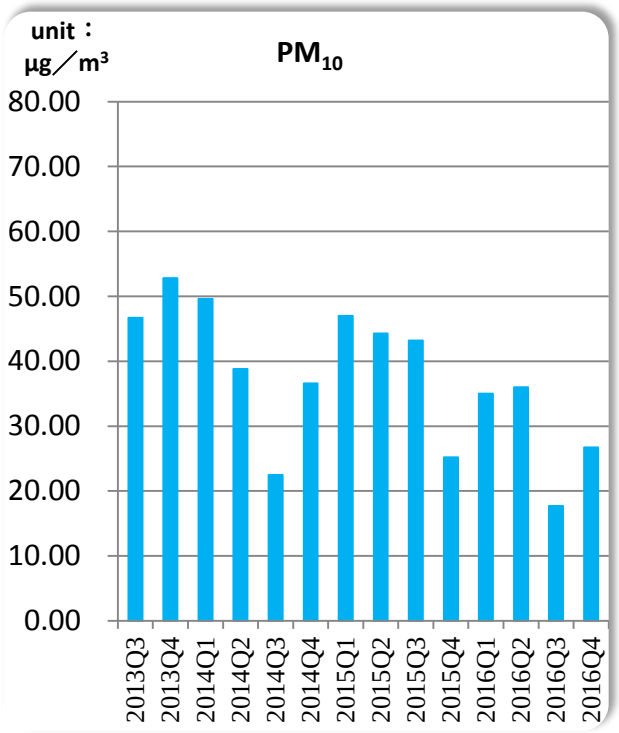
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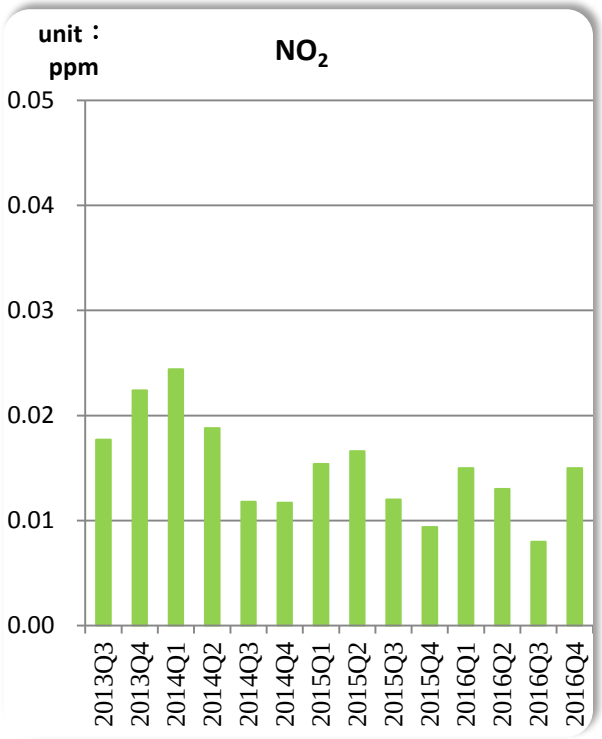
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2014Q3
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2015Q2
2015Q3
2015Q4
2016Q1
2016Q2
2016Q3
2016Q4

Greenhouse Gas Emissions

In order to achieve carbon reduction, sources of green house gases (GHGs) emissions must be identified first.

Keelung Port uses the Taiwan Air Pollution Emission Line Source Manual to calculate port GHG emissions from vessels, vehicles, and resources consumption.

Carbon Emissions from Ships

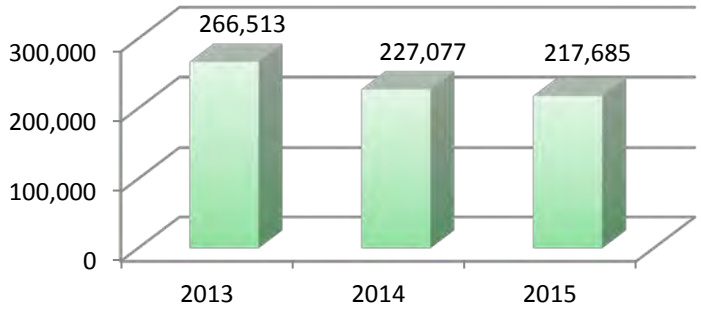
The Taiwan air pollution emission [TEDS 8.1] line source manual calculation formula was adopted to estimate carbon emissions by ocean-going vessels:

Ocean-going ship carbon emissions($kgCO_{2e}$) =
Fuel consumption (L)× Emissions factor ($KgCO_{2e}$/L)× Control factor

Note:
Fuel consumption (L) = Cargo throughput (ton)× Energy density (L/ton-km)× Harbor travel distance (km)×1000 (kg/ton)

A ship entering the harbor may switch to marine diesel oil, the properties of which are similar to those of regular diesel fuel. Therefore, the 2015 diesel fuel carbon emission factor in the EPA carbon factor database is used as a reference for the emissions factor.

Ocean-Going Ship Carbon Emissions in Keelung Port (ton)



Source: EPA

Service vessel

Carbon Emissions of Port Vehicles

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

Container truck carbon emissions($kgCO_2e$)=
Total number of vehicles per year ×
Average fuel consumption(L) in the port area×
Emissions factor($kgCO_2e$/L)× Control factor

Note:
Total number of vehicles per year={Total cargo throughput (TEU) – Container transhipment throughput (TEU)}÷2

Automotive Research & Testing Center data were reviewed to determine the average fuel consumption rate in the port area. The monthly fuel consumption rate was 2.47 km/L. The research findings of Harbor and Marine Technology Center, MOTC, were also reviewed. The average travel distance to Keelung port is 1.03km, and the round-trip distance is 2.06km.Thus, Keelung Port's fuel consumption was estimated to be 1L.

>>2015-2016 Carbon Emissions of Container Truck in Keelung Port

Year	Inward / Outward Container Throughput (TEU)	Heavy Goods Vehicle Carrying Limit (TEU)	Unit	Total Number of Passes per Year	Fuel Consumption (L)	Emission Factor ($kgCO_2e$/L)	Carbon Emissions (tonne)
2015	19,366,624	2	No. of vehicles	9683312	1	2.65	25,661
2016	17,224,244			8612122			22,822

Carbon Emissions from Resource Consumption

>>Carbon Footprint of Resource Consumption at Keelung Port

Resource	2015		2016	
	Amount of Resource Consumed	Carbon Emissions (tonne)	Amount of Resource Consumed	Carbon Emissions (tonne)
Water	135,000 m^3	20.8	106,000 m^3	16.3
Electricity	8,610,000 kwh	4,555	9,750,000 kwh	5,158
Fuel	1,499,000 L	3,538	1,496,000 L	3,531
Paper	1,675 packages	4.7	1,556 packages	4.4
Total		8118.5		8,709.7

Note: CO_2 emissions factors of resources
Water: 0.154 $KgCO_2e$ /CMD (2015);
Power: 0.529 $KgCO_2e$ /kwh(2016);
Fuel: 2.36 $KgCO_2e$ /litre;
Paper: 2.8$KgCO_2e$ / sheets(A4,70 pounds)

04/

State of the Environment

Air Quality Improvement Strategies

Environmental Friendly Vessels

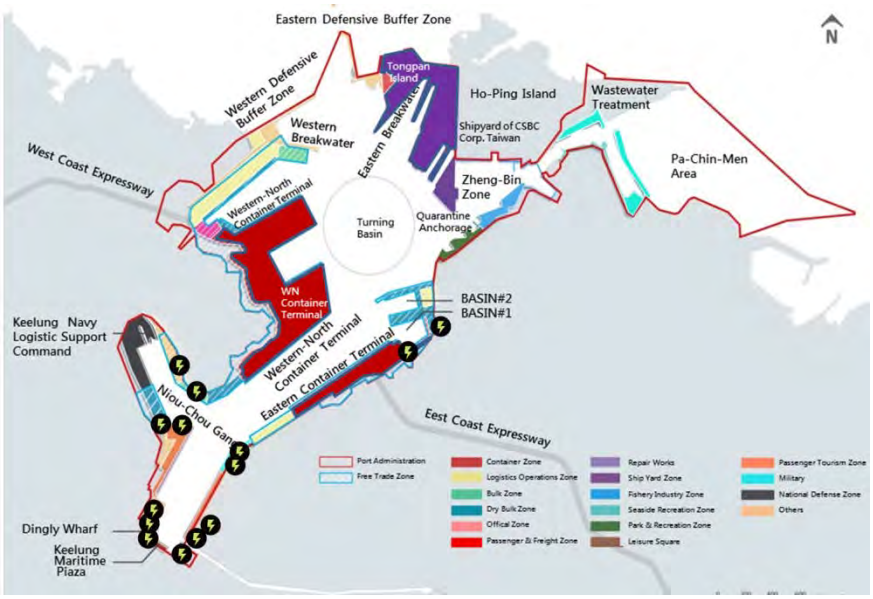
To facilitate environmental friendly vessel policies, the Port of Keelung has adopted premium diesel, which contains a sulfur content lower than 10 ppm, as the fuel for half of its harbor vessels. Moreover, the port has promoted the electrification of port service facilities, including the installation of shore power systems at official-purpose docks to supply electricity to ported vessels. A total of 14 shore power systems to reduce exhaust gas emissions from ported vessels were installed .

In addition, the Port of Keelung encourages vessel speed reduction (VSR), which is to reduce speed of vessels within 20 nautical miles to the port to under 12 knots per hour to abate air pollution.

>>Shore Power Services at Keelung Port

Operating enterprise	Cleaning boat/Sightseeing boat	Service vessel	Custom	Coast Guard	Navy	Cement ship/ Small business wheel
dock	#W1、#E2B	#W5、#W6、#W12B	#W1	#E4、#E16	#W1B、#E5、#W12	#W12、#E1

>>Shore Power Services at Keelung Port



Shore Power Systems

Fugitive Dust Emission Control

The Port of Keelung reduce air pollution, and maintaining an adequate working environment and quality of life standards at the harbor and in urban areas. The Department of Occupational Safety inspected the handling of bulk cargo at docks 390 and 617 times in 2015 and 2016, respectively, and found that carriers, shippers, freight forwarders, loading and unloading contractors, and other handlers involved handled cargo in accordance with existing environmental regulations and the Commercial Port Law.

The Port of Keelung has implemented control measures for fugitive dust emissions. The control measures has two aspects, cargo handling and vehicle control. In addition, the Keelung Port also requests stevedoring companies to abide by the related regulations.

Port of Keelung dust control machineries：
- Water sprayers：64units
- Carwash facilities：3 units

>>Keelung Port Fugitive Dust Control Measures

Aspects	Dust Control Measures
Vehicle Control	• Implemented diesel vehicle self-management program promoted by the Keelung City Government • Inspect incoming and outgoing diesel vehicles • Install water sprinklers at sand and gravel stacking sties

Dust gauze

Setting up dustcovers or dust gauze in the docks can reduce dust emission and mitigate the effect of contaminant and rainwater runoff on ocean water quality.

Carwash Facilities

Carwash facilities clean vehicles exiting construction sites to prevent dust emissions from vehicles.

04/

State of the Environment

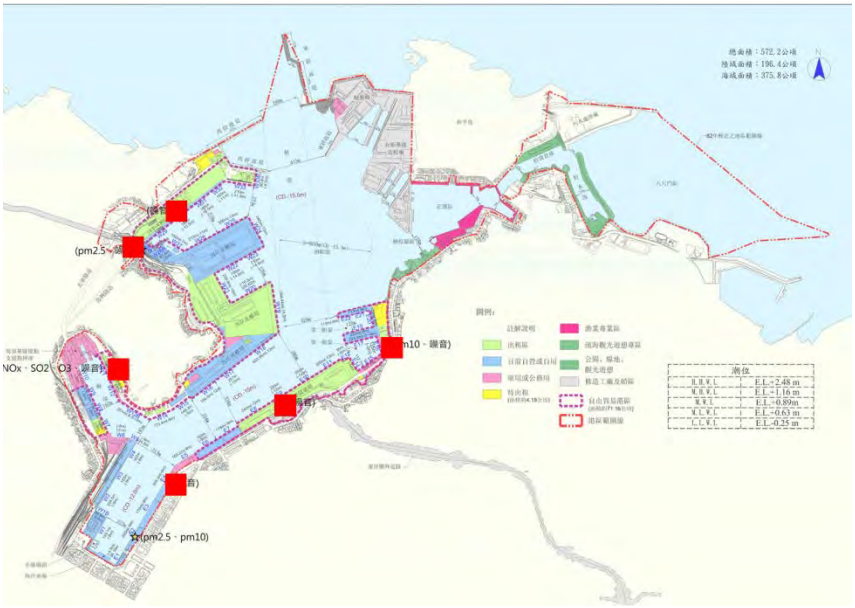
Noise

The Port of Keelung neighbors the Keelung City area. Because of noise from cargo handling, transportation, and traffic at the harbor travels to surrounding residential areas, affecting their livability. To ensure the quality of life of residents in the neighborhood of Port of Keelung, all lessees and ship operators in Port of Keelung shall restrict the noise of their operations to the statutory limits. To reduce harbor noise from vehicle, the Port of Keelung, TIPC, has built access traffic systems on the eastern and western harbor fronts and separate port traffic from the commuting routes of nearby residents and avoid disturbing community life.

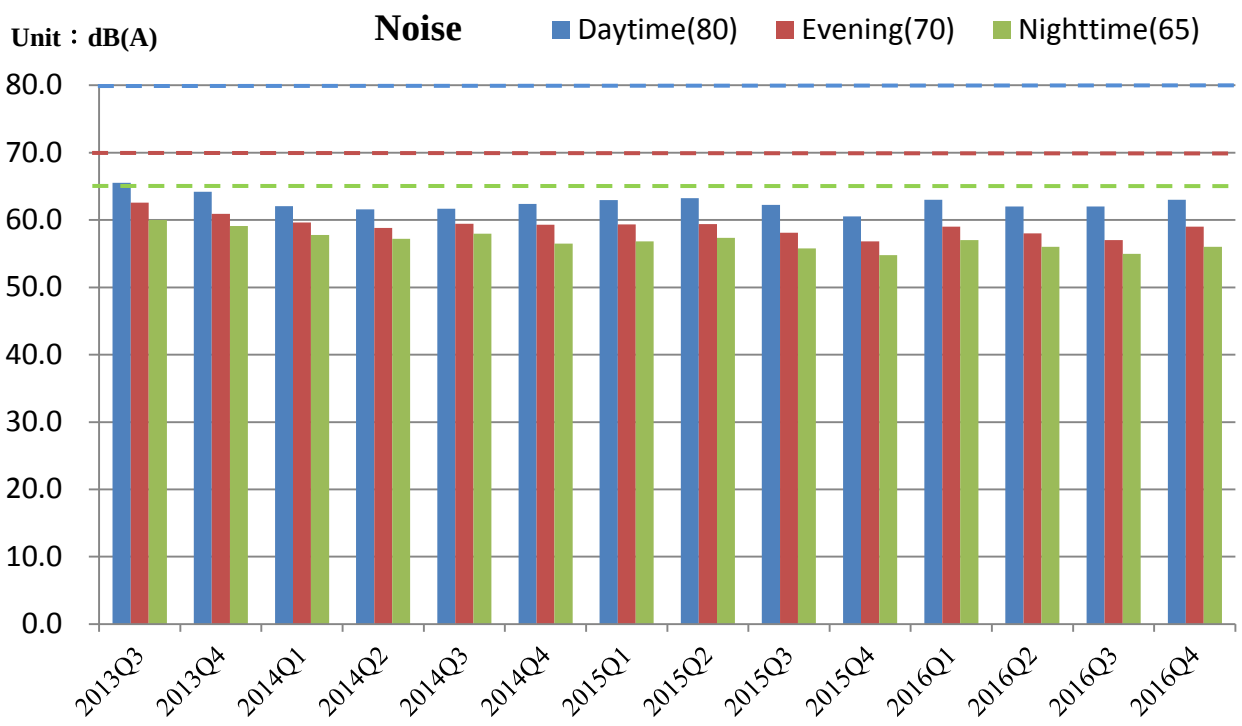
To reduce traffic-originated noise interference, the Port of Keelung, TIPC, plans to reinforce cargo handling procedures and traffic control systems and plant trees from East dock no.16 to 20 to block the noise from handling ship cargo. Currently, TIPC is planning to relocate container terminals from the east bank to the west bank of the harbor to reduce the amount of traffic and cargo handling noise affecting urban areas and surrounding communities.

The Port of Keelung area is a Class 4 noise control zone. Volume monitoring results for the day, evening, and night have demonstrated that readings exceeded at some of the test stations. This is probably due to neighboring traffic and the docking of ships at the port.

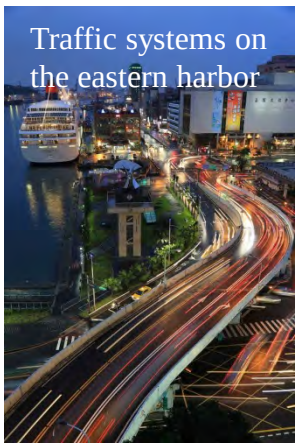
>>Noise Monitoring Stations and Sites



Port Monitoring Station




Traffic systems on the western harbor


Traffic systems on the eastern harbor


Noise detection

Meteorological Instruments

04/

State of the Environment

Water Quality

The water areas within Port of Keelung belong to Category C of the Marine Environment Classification and Marine Environment Quality Standards, whereas those off the coast of Keelung belong to Category B. A water quality test showed that the Tianliao River and Xuchuan River is higher than that in other water areas. The stretches of the rivers that are close to large drainage gutters are prone to sewage from upstream towns, and thus do not meet the Marine Environment Classification and Marine Environment Quality Standards; their biochemical oxygen demand falling short of the acceptability rate of 100%. However, other water quality test results have met required standards.

Port of Keelung receives the sewage of Keelung City; therefore, the port continuously monitors the quality of the port waters and maintains the port water pH, dissolved oxygen content, and mineral oil levels in order to achieve quarterly pass rates of 100%. Quarterly biochemical oxygen demand levels also achieve pass rates of 100%. The percentage of pollution-generating companies and operators with sewage treatment equipment is maintained at 100% in accordance with the Water Pollution Prevention Law, to prevent wastewater from being discharged into Port of Keelung.

Water Quality Sampling

>> Records of 2015, 2016 Keelung Port Water Quality

Indicators	Standards	Measurements	Pass rate(%)
pH	7.0~8.5	7.9~8.2	100
DO(mg/L)	≧2.0	5.2~7.8	100
BOD_5(mg/L)	≦6.0	1.4~1.6	100

Note: Environmental quality standards for class III marine water bodies are referenced when examining the port's water quality

Water Quality Improvement Strategies

Reduce river pollution

Numerous drains converge at the Port of Keelung, exceeding 140 outfalls that introduce greywater and sewage from the city, which raise the organic content and nutrients in the harbor seawater to considerable levels. To slow river influx pollution, the Port of Keelung, TIPC, assists the city government in maintaining harbor water space and has provided land for constructing river sewage interception stations. Wastewater interceptors intercept a combined 5,800 tons of wastewater daily, which equals the volume of wastewater from the entire city of Keelung (with a population of approximately 240,000).

Currently, Keelung Port basin collects the effluent of four major drainage channels. These channels transport upstream sewage, which deteriorates water quality in the harbor basin. To improve upstream river conditions, the Port of Keelung, TIPC, is cooperating with the EPA and Keelung City Government to construct interception stations for upstream river channels. In the construction project, the Port of Keelung, TIPC, is providing the land for construction, the EPA is funding the construction, and the Keelung City Government is supervising the construction work and is responsible for managing post construction operations.

Promote a plan to prevent and reduce pollution at ports

Newly established runoff wastewater interceptors with a detention basin reduce over 60% of suspended solids ,and total amount of suspended solids is1,158kg.

Runoff wastewater interceptor A

Runoff wastewater interceptor B

Reduce Vessel Sewage Discharge

To prevent unauthorized oily bilge discharge from entering the harbor, the Port of Keelung, TIPC, conducts to ensure that inbound ships treat their oily bilge water in accordance with regulations. The oily bilge and sewage water collection process was fully implemented in Keelung Port .

Expected to be continually maintained through periodically inspecting vessel docking environments in coordination with relevant authorities, thereby eliminating unauthorized discharge and harbor pollution.

Year	# of vessels	Oily wastewater (ton)	Implement rate(%)
2015	87	1293.32	100
2016	38	762.44	100

04/

State of the Environment

Reduce Port-generated Waste

The Port of Keelung, TIPC, is promoting waste reduction and recycling plans to reduce port and harbor waste. Recycling and waste reduction plans are implemented in accordance with the Four-in-One Recycling Program that has been promoted by Taiwan's Environmental Protection Administration (EPA) since 1997. Additionally, the EPA initiated the Mandatory Garbage Sorting requirement in 2005, in which the major recycled items include waste paper.

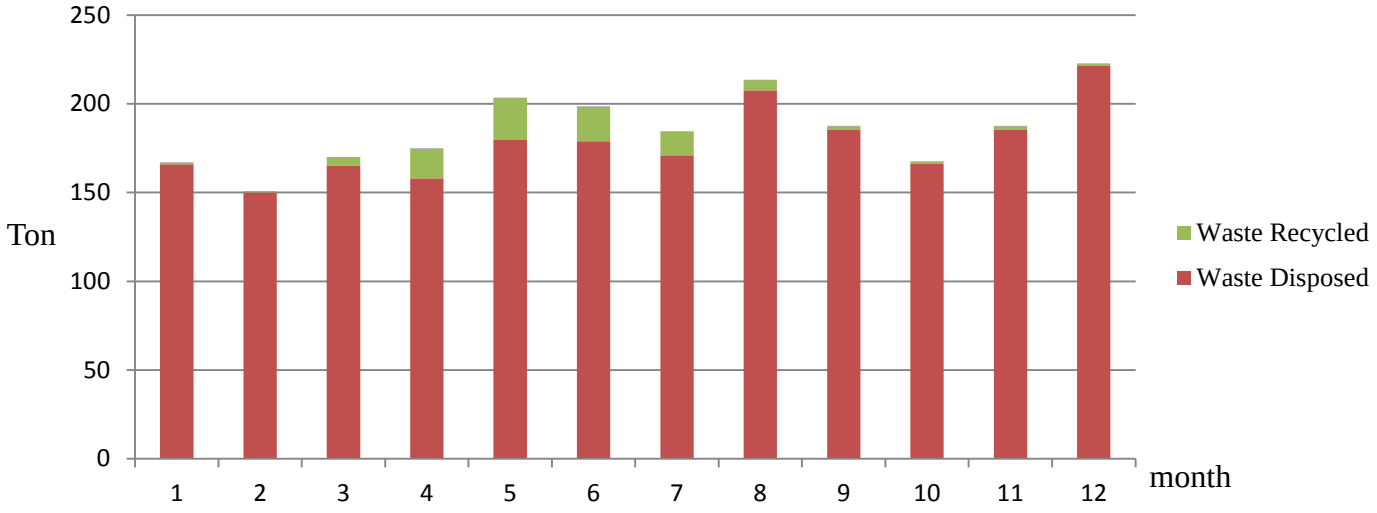
Port of Keelung commits itself to reducing wastage, increasing the volume of recycled waste, and handling waste in a manner that enables it to be recycled and reused. In 2015, general waste amounting to 1,728.09 t was removed from the Keelung Port land area, and a recycling rate of 4.24% was attained. In 2016, the general waste removed amounted to 1,694.65 t, and the recycling rate increased to 3.86%. In future, the recycling rate of all general waste collected in the area is expected to reach 3%. Due to the emphasis on the concept of diminishing sources, the reduction in the rate of resource recovery is reduced by reducing the amount of waste generated and garbage collection.

>> Amount of waste recycle & disposal at the Port of Keelung

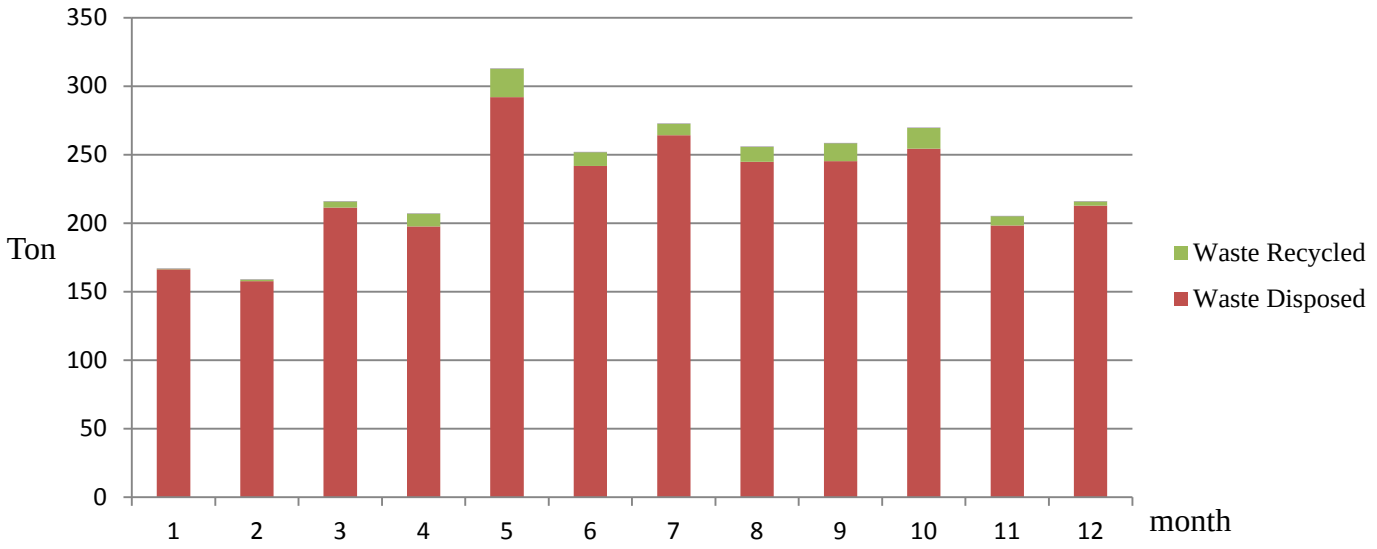
Item	2015	2016
General waste disposal (ton)	1,728.09	1,694.65
Cruise disposal (ton)	406.683	991.802
General recycle (kg)	3,247	2,625
Cruise recycle (kg)	87,470	101,010
Recycle Rate (%)	4.24	3.86

Resource recycling classification

Amount of waste recycle & disposal at the Port of Keelung in 2015



Amount of waste recycle & disposal at the Port of Keelung in 2016



Note: Waste Disposed + Waste Recycled= Total Waste Generated

04/

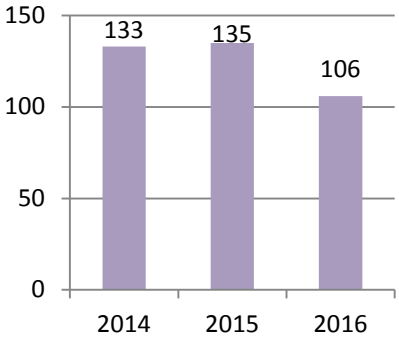
State of the Environment

Keelung Port Resource Usage

Port of Keelung is highly concerned about water and electricity use and frequently encourages all colleagues to cherish resources, establishing a consensus on conservation. Water and electricity use in the harbor are jointly monitored; upon discovery of any abnormal circumstances, the maintenance unit of the port is immediately notified, keeping resource waste to a minimum.

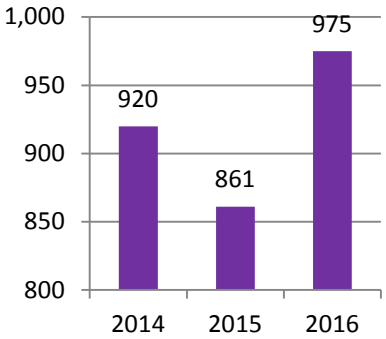
In 2015 and 2016, although the oil paper wastage of the Port of Keelung decreased on average, the Container Terminal acquired three new overhead cranes and four new gantry cranes, increasing the baseload power use. Additionally, the number of international tourists increased by 14%, and as a result, the power used for air conditioning in the tourist center increased, thus increasing electricity usage.

Water Usage (1000m^3)



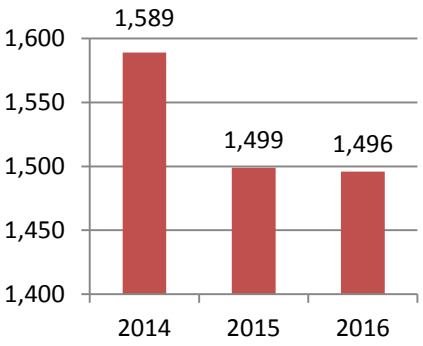
Conduct leak inspections to control monthly water usage

Electricity Usage (10 Mwh)



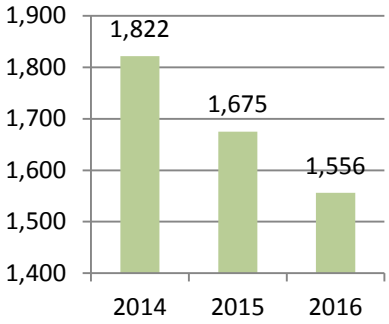
The Container Terminal acquired three new overhead cranes and four new gantry cranes, increasing the baseload power use

Fuel Usage (kiloliter)



The decrease in oil use was due to the TIPC Marine Corporation assuming responsibility for service vessels from 2015.

Paper Usage (Package)

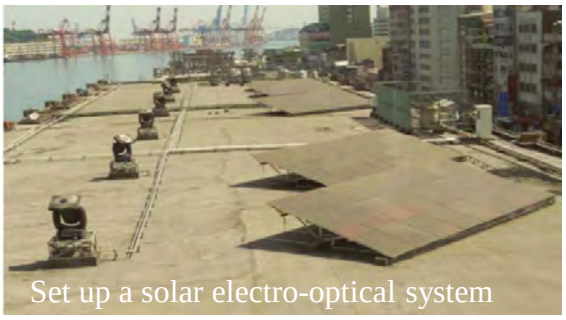


The Keelung Port is dedicated to encouraging online use of administrative and service procedures, increasing the likelihood of online document signing, and promoting video conferencing and electronic services. As a result, paper usage has decreased gradually。

Strategies for Reducing Resource Consumption

To reduce resource wastage, the Port of Keelung set up a solar electro-optical system demonstration in the Keelung Harbor Building in 2012. The system's average monthly power generation is 800 kWh, and its annual carbon reduction reaches approximately 5 tons.

Date: Established in 2012
Location: Keelung Harbor Building
Capacity: 10.4 kW
Predicted lifespan: 8 years
Amount invested: NT$1.24 million


Set up a solar electro-optical system

>> Resource Savings Strategies of Keelung Port

Category	Strategies
Water	• Conduct leak inspections to control monthly water usage
Electricity	• Turn off unnecessary lights in hall ways • Gradually replace traditional lightings to energy saving once • Do not use AC under 28℃, and keep office above 26℃ • Turn off office lightings during lunch break
Fuel	• Promote ride sharing • Limited idle speed duration to less than 3 min • Regularly recorded the fuel consumption of official vehicles
paper	• Encouraging online administrative service and online document signing • Print documents on both sides and reuse used paper


Periodic inspection

04/

State of the Environment

Improve the management of dangerous goods

The hazardous cargo storage, and transportation service companies in the port may cause potential environmental hazards because cargo leakage accidents can cause harm to neighboring ecology and residents. Therefore, improving cargo management and port security has become a crucial task for Keelung Port.

Companies operating in the port shall devise corresponding emergency response plans and organize joint disaster drills to increase their capability of addressing emergency events.

>>Inspections and Drills Conducted in 2015-2016

Year	2015	2016
Inspections	402	629
Drills	1	1
Cross Agency Inspections	1	1

Port Hazard Inspection

In accordance with its emergency response plan for the leakage of chemical substances, Port of Keelung makes emergency responses to toxic chemical leakages occurring at the port or to concerns about such incidents. In addition, the port coordinates with the response operations undertaken by the Ministry of Transportation and EPA to (1) reduce the losses due to such incidents, (2) maintain environmental well-being, (3) maintain human safety, (4) maintain regular port operations, and (5) attenuate the impact of the incident on the environment or humans.

The Keelung Branch of TIPC inspects stevedoring in the port from time to time and manages dangerous cargo in the port. In addition, the Branch contacts each port unit on a regular basis to develop emergency response plans for cargo leakage and improve the response capacity for responding to such events. The Branch stipulated that emergency response drills shall be organized at least once per year and a joint safety promotion at least one times per year.

Cargo Vehicle Inspection

Inspection of Port Cargo Handling Operations


Oil Pipeline Inspection

Cross Agency Inspections

04/

State of the Environment

Environmental Performance Indicators

Environmental Issues	Index Item	Calculation Method
Air quality	Qualification rate of air quality indices:suspended particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_2 and O_3,	Rate of air quality measurements meeting the Air Quality Standards (measured at harbor test stations)
	Replacing old devices with energy-saving devices	Proportion of use of electric gantries or overhead cranes
Port and harbor waste	General waste removed and recycling rate in the harbor land area	・Port waste removed from the harbor land area ・Port waste recycling rate in the harbor land area
Noise	Daily qualification rate for harbor noise quality	Daily rate of qualified noise quality measurements at harbor test stations (the harbor plant site is a Type 4 noise control zone, meaning that noise is limited to 80 db during daytime (7 AM to 7 PM), 70 db during evenings (7 PM to 11 PM), and 65 db during nighttime (11 PM to 7 AM)
Pollution from river influx	Ratio of river channels or canals installed with interception stations	Number of rivers channels or canals installed with interception stations ÷ total number of river channels or canals in the harbor area × 100%
Strengthen hazardous cargo management	Number of inspection container freight station managers	Number of inspection container freight station managers to implement self management plans

	Index Target	Description of Calculation	
		2015	2016
	Minimum standard for daily average PM_{10}: 100.00%; Minimum standard for daily average $PM_{2.5}$: 85.00%; Minimum standard for daily average SO_2: 100.00%; Minimum standard for hourly average SO_2: 99.95%; Minimum standard for hourly average NO_2: 100.00%; Minimum standard for hourly average O_3: 97.00%; Minimum standard for 8-h average O_3: 100.00%	・PM_{10} daily average pass rate: 100.00% ・$PM_{2.5}$ daily average pass rate: 100.00% ・SO_2 daily average pass rate: 100.00%; hourly average pass rate: 100.00% ・NO_2 hourly average pass rate: 100.00% ・O_3 hourly average pass rate: 100.00; 8-h average pass rate: 100.00%	・PM_{10} daily average pass rate: 100.00% ・$PM_{2.5}$ daily average pass rate: 82% ・SO_2 daily average pass rate: 100.00%; hourly average pass rate: 100.00% ・NO_2 hourly average pass rate: 100.00% ・O_3 hourly average pass rate: 100.00; 8-h average pass rate: 100.00%
	A usage rate of 33%	With electric overhead cranes yet to be purchased, the 12 straddle carriers have a replacement rate of 0%.	Four straddle carriers were replaced by an equivalent number of electric overhead cranes put into service in August 2016, yielding a replacement rate of 33%.
	3% port waste recycling rate in the harbor land area based on general waste removed	・General waste removed from the harbor land area; 1728.09 ton ・Amount of general resource recovery : 3,247kg ・Amount of cruise resource recovery : 87470kg ・General waste recycling rate in the harbor land area: 90.72/2134.773=4.24%	・General waste removed from the harbor land area:1694.65 ton ・Amount of general resource recovery : 2,625kg ・Amount of cruise resource recovery : 101,010kg ・General waste recycling rate in the harbor land area: 103.635/2686.452=3.86%
	Harbor noise quality: 100.00% seasonal daytime qualification rate, 95% evening, and 93% nighttime	Daytime equivalent sound energy level (Leq): 100.00% Evening Leq: 96.90% Nighttime Leq: 95.00%	Daytime equivalent sound energy level (Leq): 100.00% Evening Leq: 973% Nighttime Leq: 98%
	50% of river channels or canals with interception stations installed	1 ÷ 4 × 100% = 25% ・Number of river channels with interception stations installed: 1 ・Total number of river channels or canals in the harbor area: 4	1÷4×100%=25% ・Number of river channels with interception stations installed: 1 ・Total number of river channels or canals in the harbor area: 4
	Number of inspection container freight station managers to implement self management plans,10 times per year	Number of inspection container freight station managers to implement self management plans,2 times per year	Number of inspection container freight station managers to implement self management plans,10 times per year

04/

State of the Environment

Environmental Performance Indicators

Environmental Issues	Index Item	Calculation Method
Strengthen hazardous cargo management	Ratio of service vessels using low-emission fuels or biodiesels and the volume of low-emission fuels used by service vessels	• Number of service vessels using low-emission fuels (marine diesel oil or super diesel) ÷ total number of service vessels × 100% • Volume of low-emission fuels used by service vessels
	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
	Ratio of service vessels using shore power	Number of service vessels using shore power ÷ total number of service vessels × 100%
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%
Cargo spillage	Number of harbor inspections,cargo spillage emergency response drills,and jointly supervised harbor safety drills	Number of harbor inspections,cargo spillage emergency response drills,and jointly supervised harbor safety drills
Vehicle control gas emissions	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
Harbor water quality	Minimum standards on marine water quality: pH, dissolved oxygen (DO), biochemical oxygen demand (BOD)	Measurements of water quality tests obtained at harbor test stations conforming to marine environment classification and ocean environment 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 requiring monitoring 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) in the harbor × 100%

Index Target	Description of Calculation	
	2015	2016
100% 100% of service vessels using low-emission fuels or biodiesels	8 ÷ 15 × 100% = 53.33% ・Service vessels owned by the Port of Keelung, TIPC: 15 ・Service vessels using low-emission fuels (super diesel): 8 Low-emission fuels used by service vessels: 22,467 KL of super diesel and 1,303,990 KL of marine diesel oil	6 ÷ 12 × 100% = 50% ・Service vessels owned by the Port of Keelung, TIPC: 12 ・Service vessels using low-emission fuels (super diesel): 8 Low-emission fuels used by service vessels: 4,706 KL of super diesel (Shuttle Boat、mooring boat、surveying ship)and 1,333,990 KL of marine diesel oil
40%・201745% At least maintain 100 meeting or through written propaganda letter per year, and the vessel reduction speed goal shall reach 40% in 2016, and 45% in 2017	・Upon entering the port, ships are asked by radio to decelerate (however, this request has not been noted in any engine room logbooks). ・The request for deceleration should be advocated (approximately 250 times each year) at the daily berth meeting.	・Upon entering the port, ships are asked by radio to decelerate (however, this request has not been noted in any engine room logbooks). ・The request for deceleration should be advocated (approximately 250 times each year) at the daily berth meeting. ・The average ratio of vessel speed reduction has reached 32.82% in 2016
100% All service vessels using shore power	15 ÷ 15 × 100% = 100% ・Number of service vessels: 15; number of service vessels using shore power: 15	12 ÷ 12 × 100% = 100% ・Number of service vessels: 12; number of service vessels using shore power: 12
100% oily bilge water cleanup	87÷87 × 100% = 100% ・Cleanups conducted by relevant vessels (oily bilge water): 87 ・Total oily bilge water collected: 1,293.32 t	38 ÷38 × 100% = 100% ・Cleanups conducted by relevant vessels (oily bilge water): 38 ・Total oily bilge water collected: 762.44 t
・100 harbor inspections ・At least one cargo spillage emergency response drill per year ・At least 1 jointly supervised harbor safety drills per year	・402 harbor inspections ・At least one cargo spillage emergency response drill per year ・At least 1 jointly supervised harbor safety drills per year	・629 harbor inspections ・At least one cargo spillage emergency response drill per year ・At least 1 jointly supervised harbor safety drills per year
・Number of lanes equipped with automated gate control: 6 entry lanes and 9 exits lanes ・Minimum number of personnel access cards: 700 each year	・Ratio of entry lanes with automated gate controls: 6 ÷ 6 × 100% = 100% ・Ratio of exit lanes with automated gate controls: 9 ÷ 9 × 100% = 100%	・Ratio of entry lanes with automated gate controls: 6 ÷ 6 × 100% = 100% ・Ratio of exit lanes with automated gate controls: 9 ÷ 9 × 100% = 100%
Qualification rate for water quality of the water area in pH, DO contents (seasonal): 100%; qualification rate for seasonal BOD_5: 95%	Class C marine water quality standard pH100.00% DO 100.00% BOD5 100.00%	Class C marine water quality standard pH100.00% DO 100.00% BOD5 100.00%
Ratio of certified operators requiring monitoring or operators that own wastewater (sewage) treatment equipment permitted for use under the Water Pollution Control Act: 100%	12 ÷ 12 × 100% = 100% ・Number of certified operators requiring monitoring: 0 ・Number of operators that own wastewater (sewage) treatment equipment: 12 ・Number of operators within the harbor that generate wastewater (sewage): 12	12 ÷ 12 × 100% = 100% ・Number of certified operators requiring monitoring: 0 ・Number of operators that own wastewater (sewage) treatment equipment: 12 ・Number of operators within the harbor that generate wastewater (sewage): 12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Emergency Response

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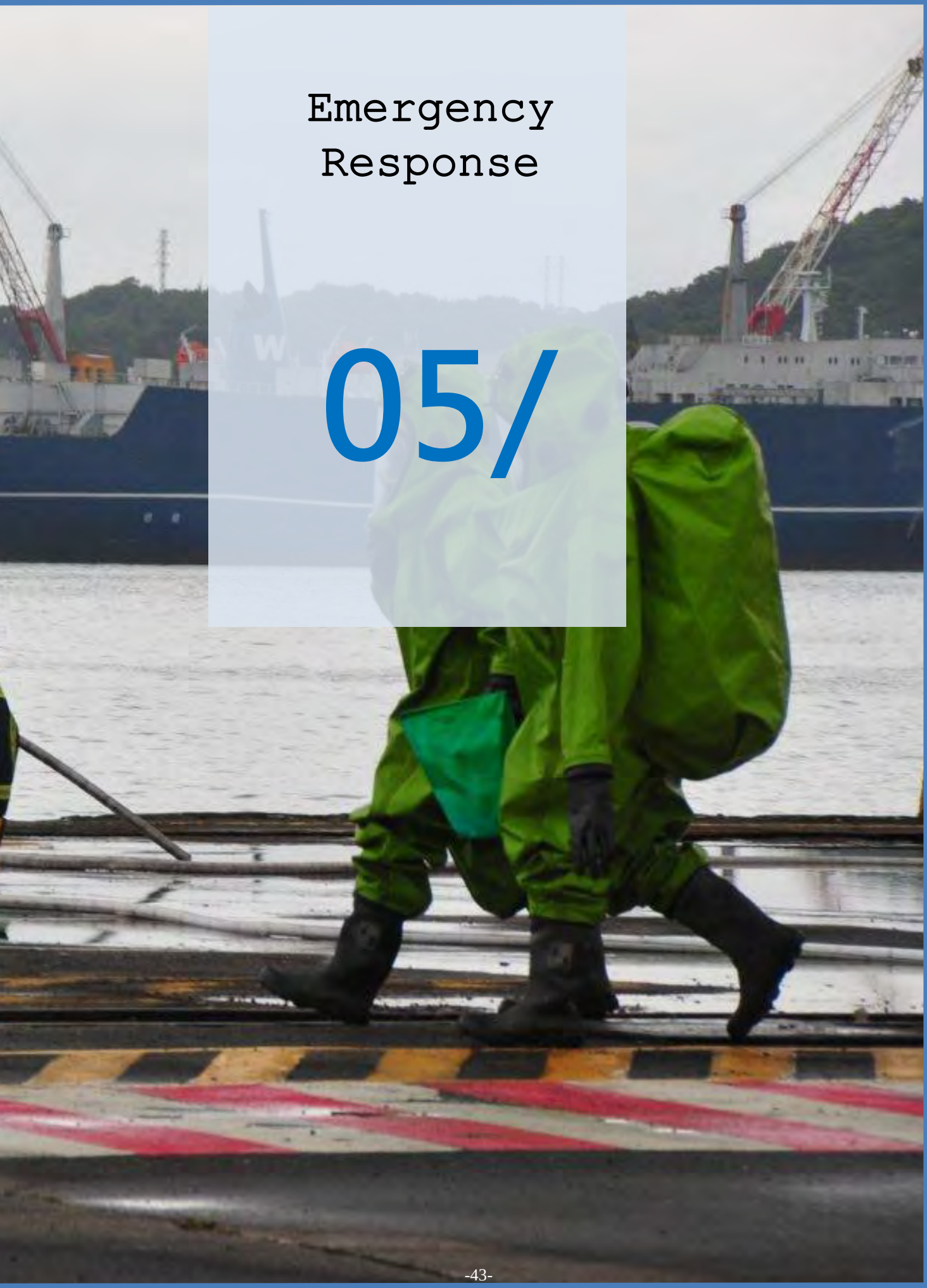

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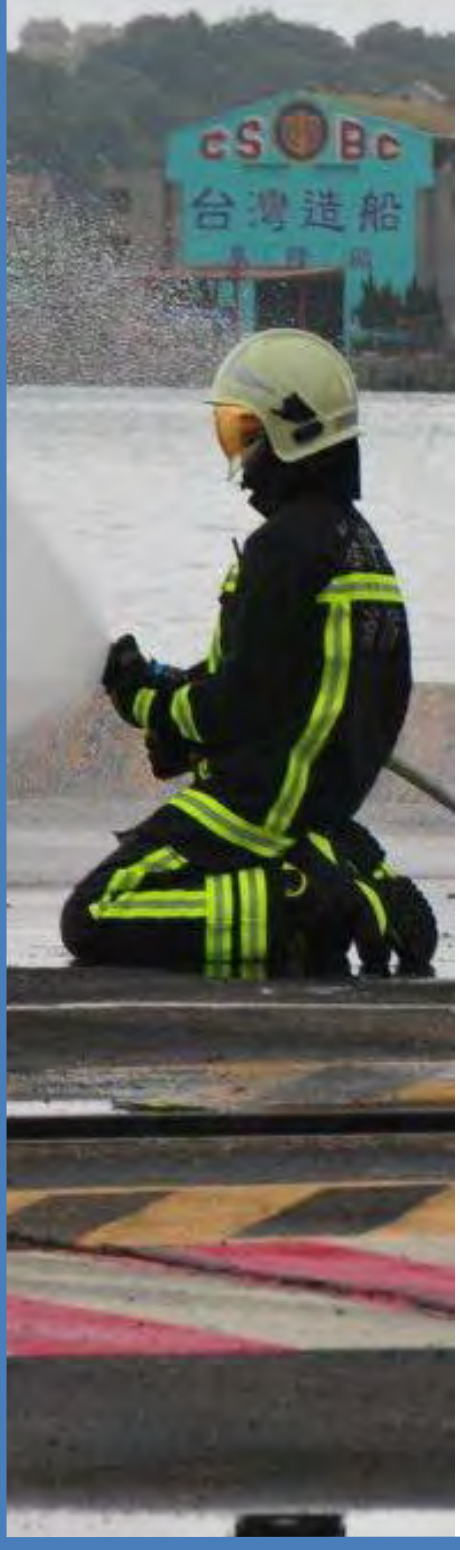
Emergency Response



Port Emergency Notification and Drill

In order to maintain port safety, Port of Keelung conducts daily land and marine environment inspection. When any suspicious behavior was identified, the inspection personnel will immediately notify for correction or inform competent legal authorities for legal enforcement. In 2015 and 2016, major port accidents were construction site leakage and vessel collision (no spillage).

For port pollution and disaster, Port of Keelung , Keelung City Environmental Protection Department, and the Northern Maritime Affairs Center of Maritime and Port Bureau of MOTC each accepts Public Nuisance Petitions.

Regarding catastrophic events such as vessel or fire explosions, the Port triggers emergency response procedure to cope with disastrous incidence.

>>Keelung Port 2015-2016 Accidental Incidents

Accident type/Year	2015	2016
Vessel collision, shipwreck, fire, oil and other chemical spillage	5	4
Ship machinery breakdown, tilt, strand	0	0
Major warehouse, storage tank explosion	0	0
Port minor pollution, fire, chemical spillage	0	6
Man overboard, occupational accident, sea drifter, others	4	4

Port of Keelung Emergency Response Drills

Port environment Inspection

To ensure port safety, the Branch Office imposed regulations on bulk stevedoring, increased the management of stevedoring, prevented overloading or leaking, and improved emergency response plans and communication mechanisms.

>>2015-2016 Keelung Port Inspection Statistics

Year	2015	2016
Port Environmental Inspection	402	629
Penalty from Legal Authority (MPB)	0	0
Pollution Prevention Spot Check	0	5

>> 2015-2016 Keelung Port Drill Records

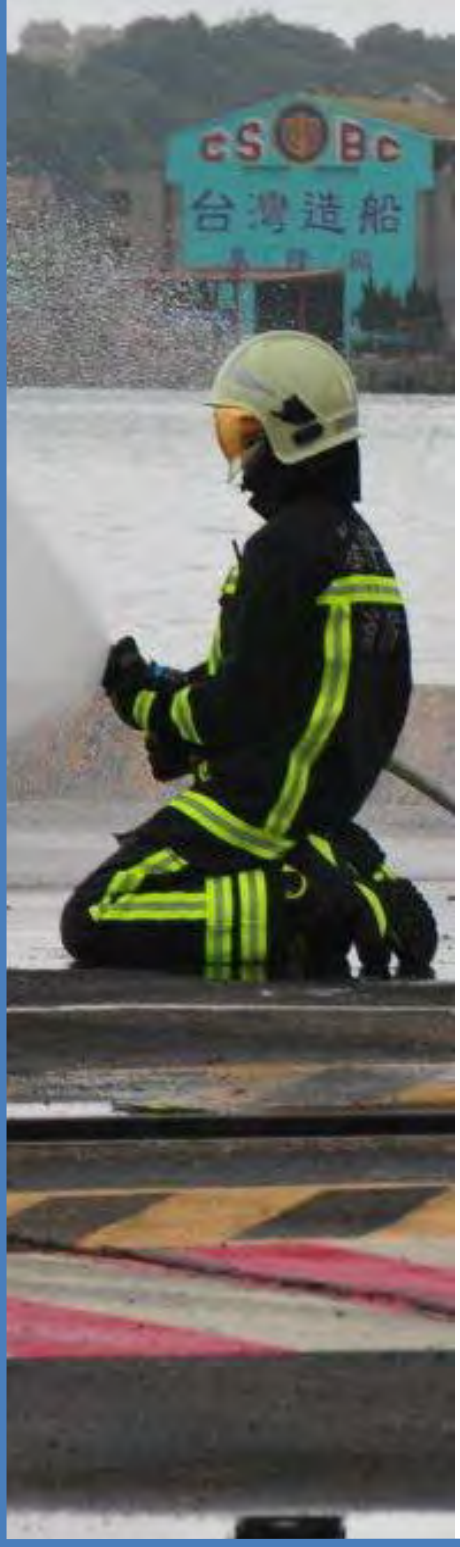
Year	Name of the Drill	Content	Dates
2015	2015 Port of Keelung International Ships and Port Facilities Preservation and Marine Chemical Leak Strain Drills	As an emergency response to marine chemical substance leaks and fires or suspicions of these events, we have enhanced the emergency response capacity of maritime transport of dangerous goods, establishing standard operating procedures through training such that disasters can be managed quickly when they occur. This is to enable related units to become familiar with the disaster relief procedures, prevent staff injuries and property damage, and enhancing the management capacity during emergency response in the port.	Dec 9
2016	2016 Serious Personal Security Events Actual Police Drill and Implementation Plan	Within 5 minutes of a major security event occurring, the onsite police response center worked with each unit to initialize response mechanisms, evacuating and calming people to prevent stampede incidents. Medical, ambulance, and other support units arrived on-site and after reporting to the district commanders of each area, cooperated with the police in the rescue of injured individuals.	Mar 15
2016	2016 Port of Keelung Port Security and Disaster Prevention Drill	Drills were undertaken of response methods to prevent explosions, terrorist attacks, and other situations in order to avoid increases in disaster casualties. Furthermore, to improve response to high-altitude fires and responses to dangerous cargo container leaks, similar situations were simulated and fire and disaster rescue and chemical leak sealing response drills were performed.	Sept 6

of Keelung Port Disaster Prevention Drills

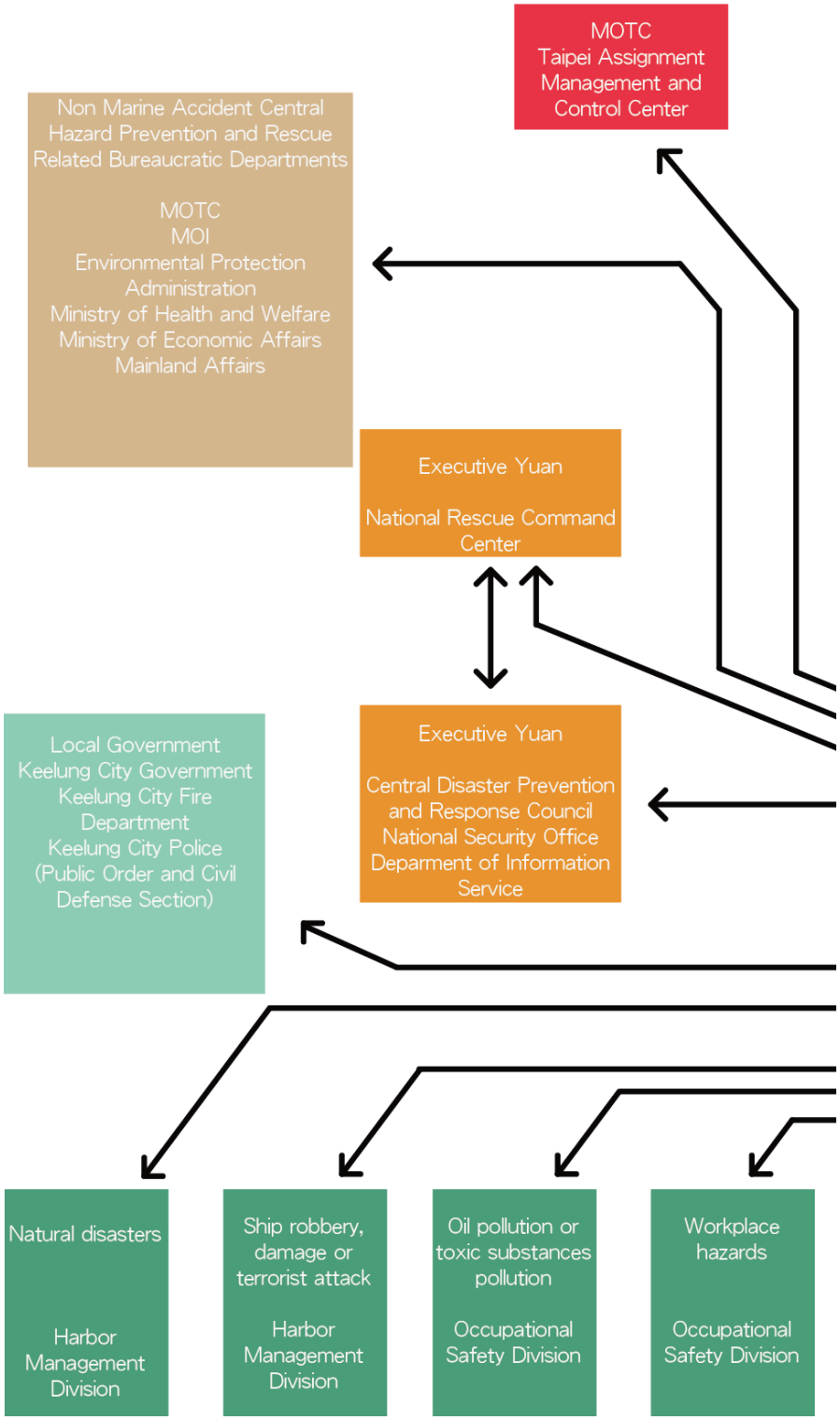
Port of Keelung Fire Drills

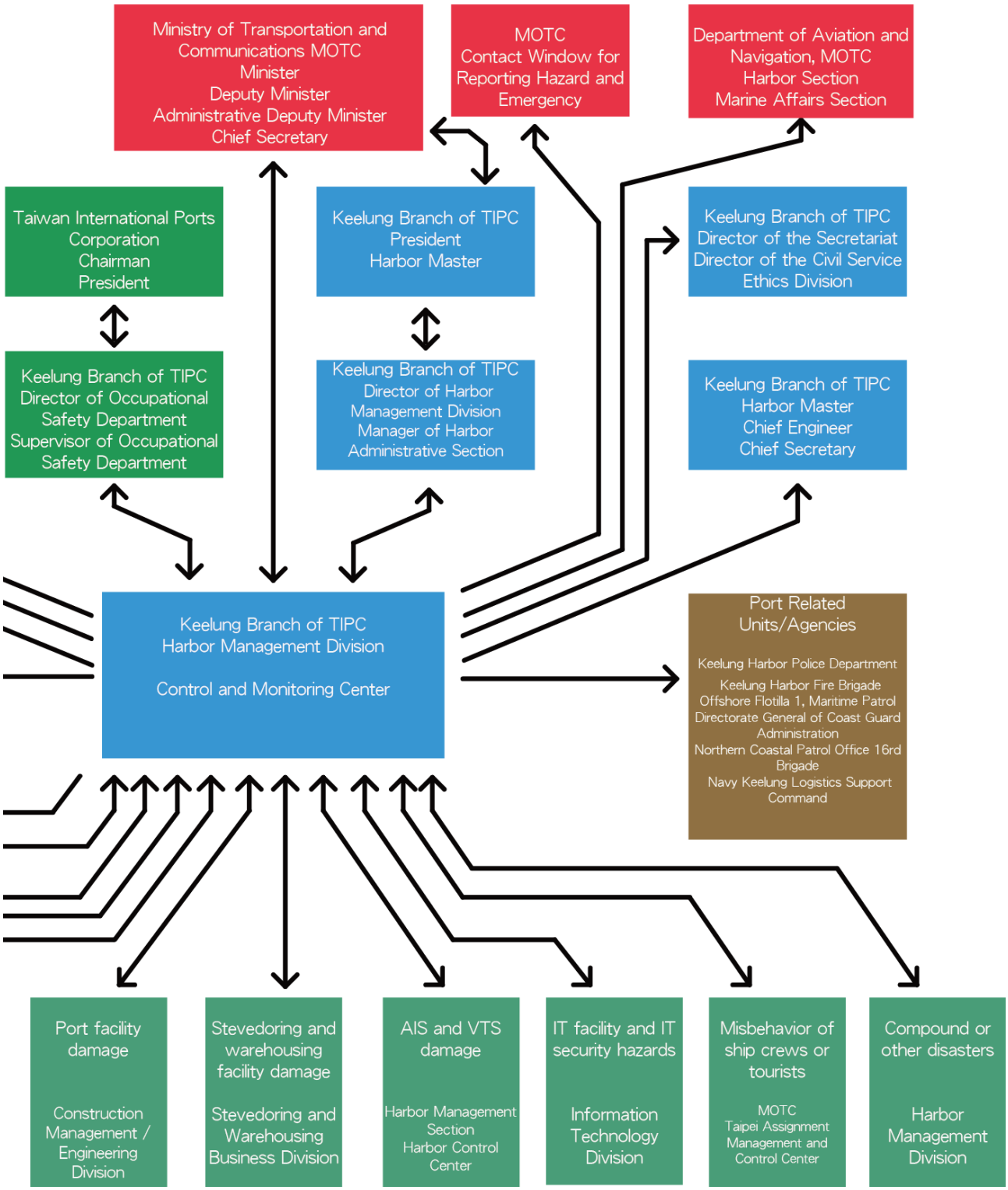
05/

Emergency Response



Port of Keelung Emergency Response



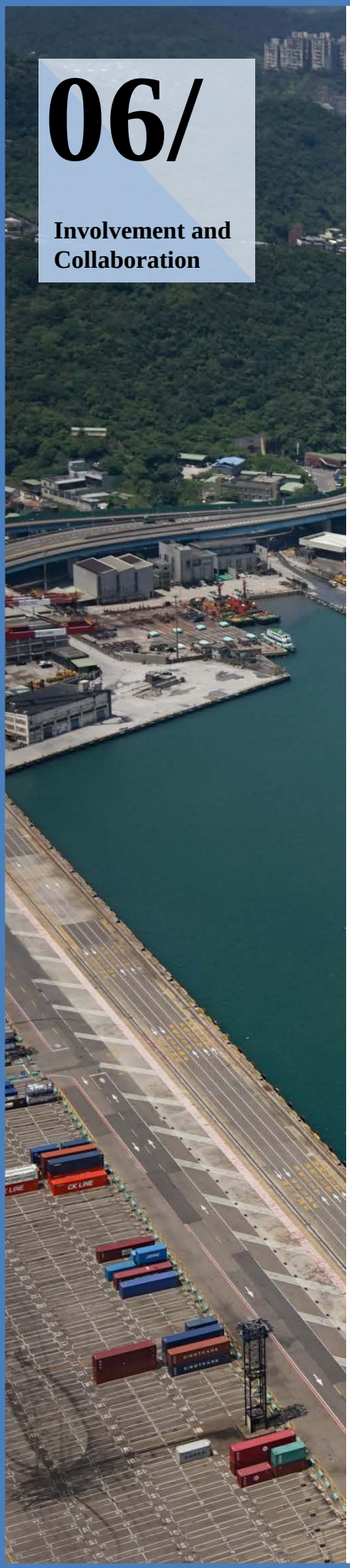

Ministry of Transportation and Communications MOTC
Minister
Deputy Minister
Administrative Deputy Minister
Chief Secretary
MOTC
Contact Window for Reporting Hazard and Emergency
Department of Aviation and Navigation, MOTC
Harbor Section
Marine Affairs Section
Taiwan International Ports Corporation
Chairman
President
Keelung Branch of TIPC
President
Harbor Master
Keelung Branch of TIPC
Director of the Secretariat
Director of the Civil Service Ethics Division
Keelung Branch of TIPC
Director of Occupational Safety Department
Supervisor of Occupational Safety Department
Keelung Branch of TIPC
Director of Harbor Management Division
Manager of Harbor Administrative Section
Keelung Branch of TIPC
Harbor Master
Chief Engineer
Chief Secretary
Keelung Branch of TIPC
Harbor Management Division
Control and Monitoring Center
Port Related Units/Agencies
Keelung Harbor Police Department
Keelung Harbor Fire Brigade
Offshore Flotilla 1, Maritime Patrol Directorate General of Coast Guard Administration
Northern Coastal Patrol Office 16rd Brigade
Navy Keelung Logistics Support Command
Port facility damage
Construction Management / Engineering Division
Stevedoring and warehousing facility damage
Stevedoring and Warehousing Business Division
AIS and VTS damage
Harbor Management Section
Harbor Control Center
IT facility and IT security hazards
Information Technology Division
Misbehavior of ship crews or tourists
MOTC Taipei Assignment Management and Control Center
Compound or other disasters
Harbor Management Division


CK LINE
SINOTRANS

Involvement and Collaboration

06/

Port of Keelung has established best practices for issues concerning the port environment, which include (1) Establish electric rail-mounted gantry cranes ; (2) The Smile Harbor at the Keelung port ; (3) Runoff wastewater interceptors at the docks。In addition, the proposed example of best practices can be incorporated into the database of the ECO Sustainable Logistic Chain as a reference for other EcoPorts.



06/

Involvement and Collaboration

Innovation

Establish electric rail-mounted gantry cranes

Concern/Motivation

Port of Keelung has increasingly replaced straddle carriers with electric rail-mounted gantry cranes to improve the environmental well-being of the port. Although the existing 14 straddle carriers are powered by diesel engines that meet the required standards of environmental friendliness, they still emit certain amounts of exhaust. If the engines are all replaced by electric motors, the air quality of the port will improve. Therefore, new electric rail-mounted gantry cranes will be acquired and applied in loading and unloading operations as the straddle carriers are gradually phased out.

Solution

Four newly acquired electric rail-mounted gantry cranes have been installed in the loading and unloading zones in West docks #22 and #23 to replace an equivalent number of diesel straddle carriers. This action has reduced exhaust emissions by nearly 30%. Notably, each of the cranes is capable of stacking five containers, compared with three for the carriers. Mounted on a rail, the crane dispenses with the path for a straddle carrier that is otherwise left between bottom containers. This improves the utility of a loading and unloading zone at a container terminal in a manner that can increase the number of containers stacked and contributes to the savings made from operating costs that can be put toward the prevention and reduction of environmental pollution.

Effects/Benefits

- Reduce exhaust emissions by an estimated 54.6%
- Reduce operating costs by an estimated 25%

Environmental Issues

Air pollution; Global warming

Participants

Keelung Branch of TIPC

Implementation/Timeline

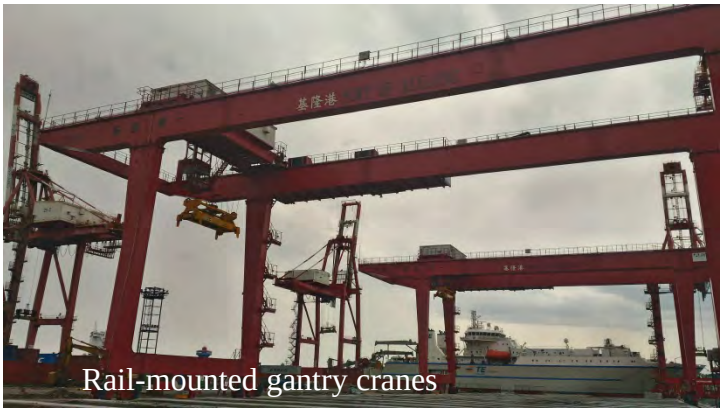
Dec 2014	contract
May 2016	Completed and began operation

Investment

Totals 210 million NTD.

Stakeholders

Port operations unit、The public



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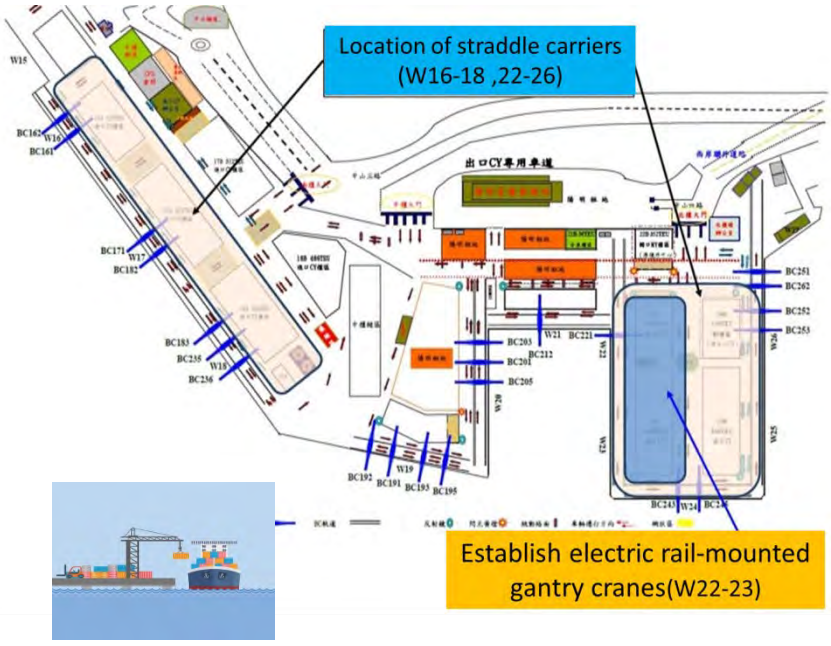

Location of straddle carriers

Strategies：Enabling

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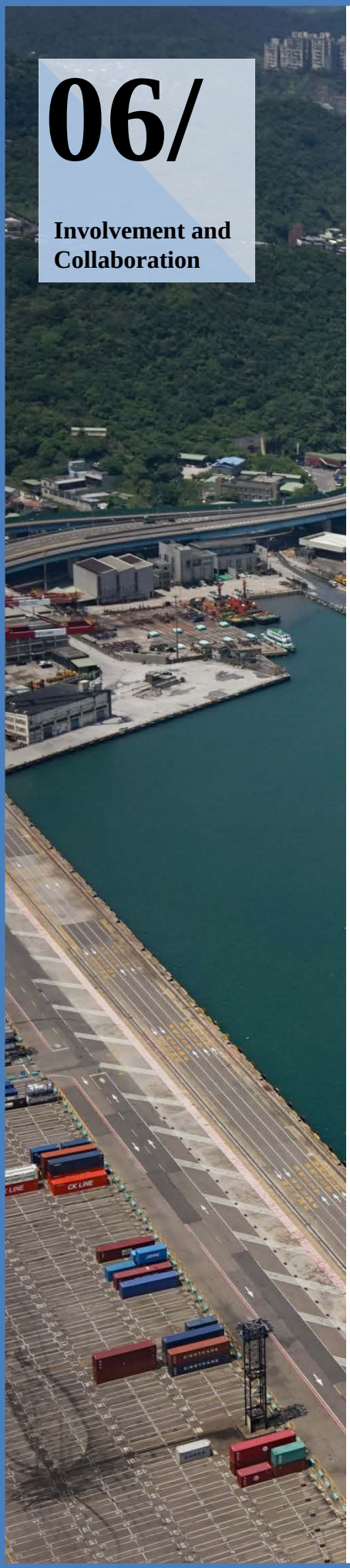
Fax：02-24256657
E-mail：tsao@twport.com.tw



06/

Involvement and Collaboration

The Smile Harbor at the Keelung port

Concern/Motivation

Port of Keelung is in proximity to downtown Keelung. After the port was granted EcoPort status by the European Sea Ports Organization in November 2015, deck trails along the docks of the port and trails for plazas were established to provide a recreational space near the port and contribute to the prevention and reduction of environmental pollution.

Solution

Exhaust gas in the inner port area can be reduced at the following docks by using shore power sites and water facilities: E1 and E2, which are on the east coast; and W1A and W1B on the west coast. At present, the first stage of the inner harbor path at Smile Harbor has been completed. Construction in the first stage primarily comprised a connection between the Maritime Plaza and the north exit of Keelung Station. The design has two routes; the first route is called the sea route and establishes a recreational path by the sea. The access restrictions on previously restricted areas in the marina have been lifted, and a pedestrian path that connects to the Maritime Plaza has been re-established. The second route is called the land route and the number of motorcycle parking spaces has been reduced to expand the pedestrian path, linking to the Maritime Plaza through the marina to form a high-quality, urban pedestrian space.

Effects/Benefits

- Permeable paving is used to increase the groundwater content, thereby indirectly influencing the heat index, enabling environmental conditioning, and contributing to the sustainability of the ecological system.

Environmental Issues

Air pollution, Global warming

Participants

Keelung branch of TIPC

Implementation/Timeline

May 2016	Construction began
Oct 2017	Completed

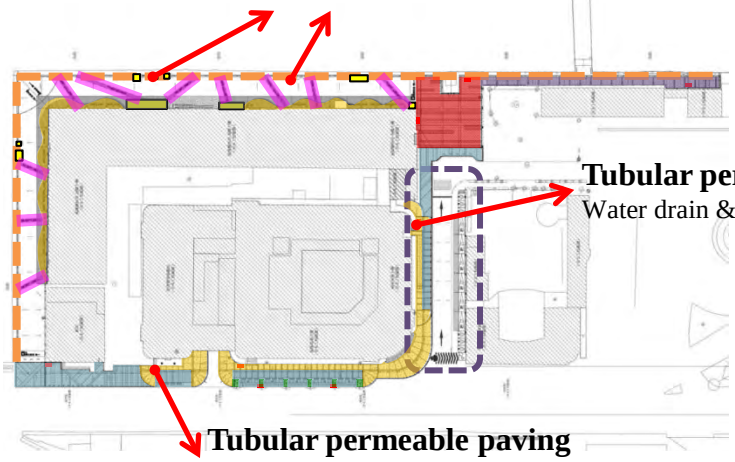
Investment

Totals 30 million NTD

Stakeholders

Port operations unit、The public

Beautify shore power & waterfront facilities



Tubular permeable paving
Water drain & conservation, Urban ecology

Tubular permeable paving
Water drain & conservation, Urban ecology

Strategies：Exemplify、Enable

Port of Keelung
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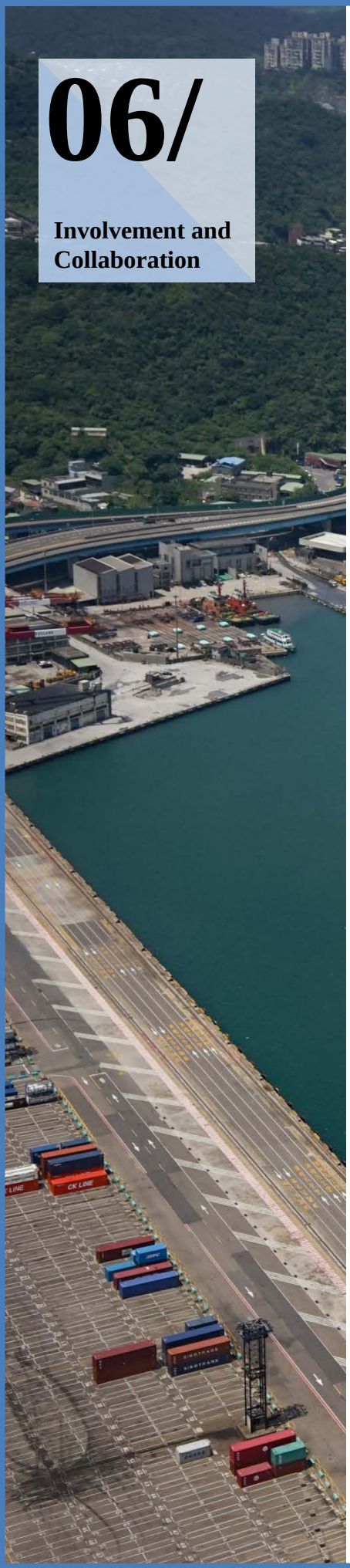


06/

Involvement and Collaboration

Runoff wastewater interceptors at the docks

Concern/Motivation

Port of Keelung is a commercial port in operation. To review pollution prevention measures for the port in a manner that can ensure the proper management and treatment of wastewater, Port of Keelung has formulated a plan to prevent and reduce pollution at ports. The plan involves collecting surface runoff and waste from the dock and its backland area at various times of year to attenuate the environmental impact of water effluents from the port on peripheral waters, thereby making the port increasingly environmentally friendly.

Solution

In order to manage pollution prevention measures for the port, to collect surface runoff and waste from the dock and its backland area at various times of year. A short-term plan implemented by Port of Keelung involves constructing facilities in the operation zones at aggregate terminals (East docks #19–22, West dock #27 and its backland area, and West docks #30–32) that intercept and detain runoff wastewater. Once implemented, this plan is expected to reduce runoff wastewater by over 60%. The cleaning and maintenance of these facilities will be overseen by warehouse superintendents at the designated docks.

Effects/Benefits

Newly established runoff wastewater interceptors with a detention basin reduce over 60% of suspended solids, and total amount of suspended solids is1,158kg

Environmental Issues

Water quality, Rainwater treatment, Marine sediment pollution

Participants

Keelung branch of TIPC、Port stevedoring industries

Implementation/Timeline

May 2016 Construction began
Oct 2017 Completed

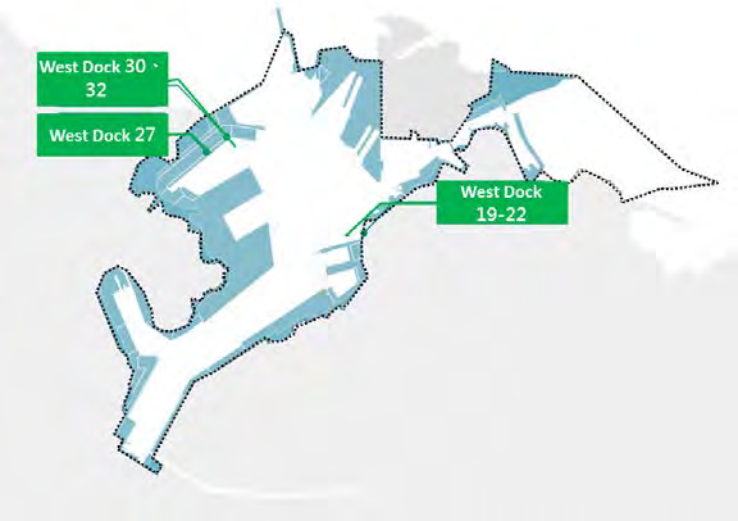
Stakeholders

Port operating units

Investment

Totals 1.796 million NTD

Location	Length (meter)	Schedule planning
East docks #19–22	627.6	6
West dock #27 and its backland area	215	7
West docks #30–32	721	8
Total	1563	Construction time is 240 days, estimated 270 days



Runoff wastewater interceptors at the docks of configure

Strategies： Enforcing、Enabling、Encouraging

Port of Keelung
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06/

Involvement and Collaboration

Involvement and Collaboration

The Keelung Port actively collaborates with both domestic and international organizations, including governmental agencies, academics, and industries. Besides sustainable development related exchanges, there are also joint collaboration on technological research, investment, inspection, and academic seminar etc.

Participation organizations

Association

Association of Pacific Ports(APP)

The APP aims to gather port authorities along the Pacific coast to discuss Pacific marine transportation development, seeking solutions for problems.

The International Association of Ports and Harbors(IAPH)

The IAPH is a NGO with tremendous influence on global port authorities, IAPH also provide the advisory to the main bodies of UN (eg. ECOSOC, IMO , UNCTAD , UNEP , ILO, WCO). The IAPH holds biennial conferences alternately in America, Asian Pacific, and European and African regions.

Shipping

Shanghai International Port Co., Ltd

TIPC began working with Shanghai International Port Co. in 2014 to boost technical standards at the two ports. The focus of this collaboration is on the exchange of information concerning equipment maintenance, green energy, environmental protection, and new technical applications.

Ports

Port of Dover

In 2011, the Port of Keelung, TIPC signed a memorandum of cooperation with the Port of Dover, which established a long-term relationship between the two parties in the areas of port risk management system deployment, risk management equipment development, safety management system development and audits, technical training, support, and environmental management systems.

Port of Hakata

The port of Hakata has been actively improving port affairs, IT systems, and relevant environmental protection measures in partnership with TIPC since 2014. For example, the ports have exchanged information on electrical RTG cranes, sunshades for mobile refrigerated containers, and hybrid straddle carriers.

Port of Yatsushiro

On August 10, 2015, Port of Keelung began sister port relations with Yatsushiro Port, becoming port partners. Together, they developed new shipping lines for container ships and cruise ships and mutually exchanged and cooperated in various areas, such as economies related to the development of the two ports.

Academic Institution

National Taiwan Ocean Univ.

National Sun Yet-Sen Univ.

National Cheng Kung Univ.

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.

Government

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 Keelung, TIPC worked with the Institute of Transportation on many projects such as “How factors of port areas services in Keelung harbor affect cruise passengers’ satisfaction " and " The real-time acoustic wave and current profile monitoring system,” etc.

Environmental Protection Administration

The EPA, Executive Yuan collaborates with the US EPA in accordance with the “Agreement between the American Institute in Taiwan and the Taipei Economic and Cultural Representative Office in the United States for Technical Cooperation in the Field of Environmental Protection (1993)," and this partnership has led to development of a series of strategies relating to port environmental issues.

North Maritime Affairs Center, Maritime and Port Bureau, MOTC

North Maritime Affairs Center, Maritime and Port Bureau, MOTC is in charge of Port safety, disaster rescue, pollution prevention services , responsible of decree execution, evidence collection, conducts joint spot check and pollution prevention drills.

Bureau of Environmental Protection, Keelung City

The Port of Keelung, TIPC and the Bureau of Environmental Protection of Keelung City collaborate in regular joint audits and drills in the port areas, and together assist the EPA in organizing relevant meetings and drafting proposals.

Wild Bird Society of Keelung

The Port of Keelung, TIPC has allowed the Wild Bird Society of Keelung to conduct an observation plan in the port's aquatic areas as part of a project to reconstruct black kite ecology at Keelung port.


基 港
Keelung Harbor Build

Training

07/

07/ Training

Employee Education

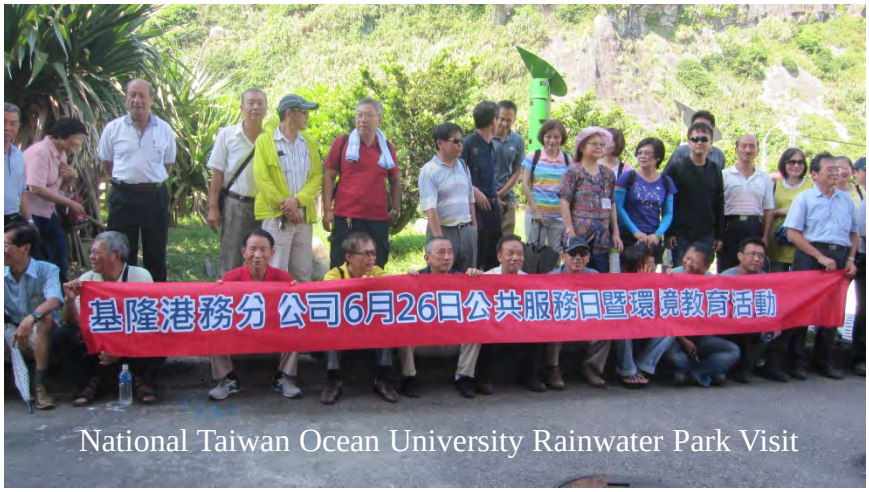
In compliance with its environmental policies, the Keelung Port provides suitable environmental education and training programs to raise environmental awareness, and improve the competitiveness of the Port of Keelung.

In 2015 and 2016, the Keelung Port organized in total 42 environmental education courses for its staff members. The total learning hours exceeded 5800 hours. The course content included the viewing of films, school and social environmental education, and information about disaster prevention and response, nature conservation, pollution prevention and control, environment and resource management, cultural conservation, and GH accounting.

GH accounting Education Training

>>Port of Keelung 2015-2016 Environmental Education Training

Year	Content	Total hours	Number of person
2015	The viewing of films, school and social environmental education, and information about disaster prevention and response, nature conservation, pollution prevention and control, environment and resource management, and cultural conservation	3348	839
2016	The viewing of films, school and social environmental education, and information about disaster prevention and response, nature conservation, pollution prevention and control, and GH accounting	2670.5	661



National Taiwan Ocean University Rainwater Park Visit

Keelung City Tianwaitian Landfill Treatment (Incineration) Plant Visit

Environmental Protection Improvement Forum


GOLDEN PRINCESS

Communication and Publication

08/

08/

Communication & Publication

Communication & Publication

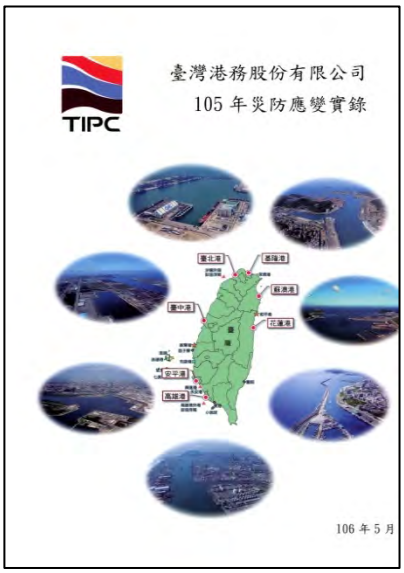
Promotion activities, seminars, workshops, publication, web-sites, and exhibitions have been organized to align Keelung Port with contractors and potential partners.

Therefore, publishing the port's relevant information is helpful to the public, port companies, academic institutions, and subsidiary units.

Environmental monitoring report, TIPC

Shining Port of Keelung: Celebrating 130 years

Travel Through Time and Space; Explore the Keelung Harbor Building



2016 Disaster Response Records

Port & City Interaction

Port of Keelung Book-Crossing Event

Websites

Port of Keelung Great Nautical King Summer Campgames

Participation in Keelung City sports

One Hundred Santa Clauses Take a Pirate Ship to the Port of Keelung

Port of Keelung 130th Anniversary Concert

08/

Communication & Publication

Communication & Publication

Community Activity

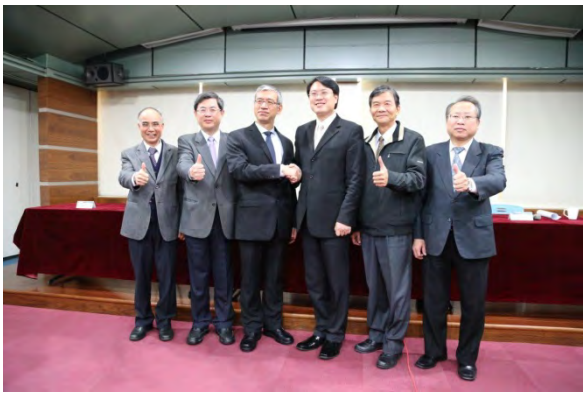
Sending Love in a Rainy City: Gratitude Tea Party

Marine Education Train Ceremony

Double-Ninth Festival: Care for Elders

Port Visitors

Mayor Ko of Taipei City and his wife visit the Port of Keelung



Mayor Lin of Keelung leading the City Council in an Official Team Visit

Community Services

Expressing Thanks for the Service Provided by the Northern Lighthouse Station Staff

Cherish the Earth: Green Movement Beach Clean-up Hike

Promotional Events

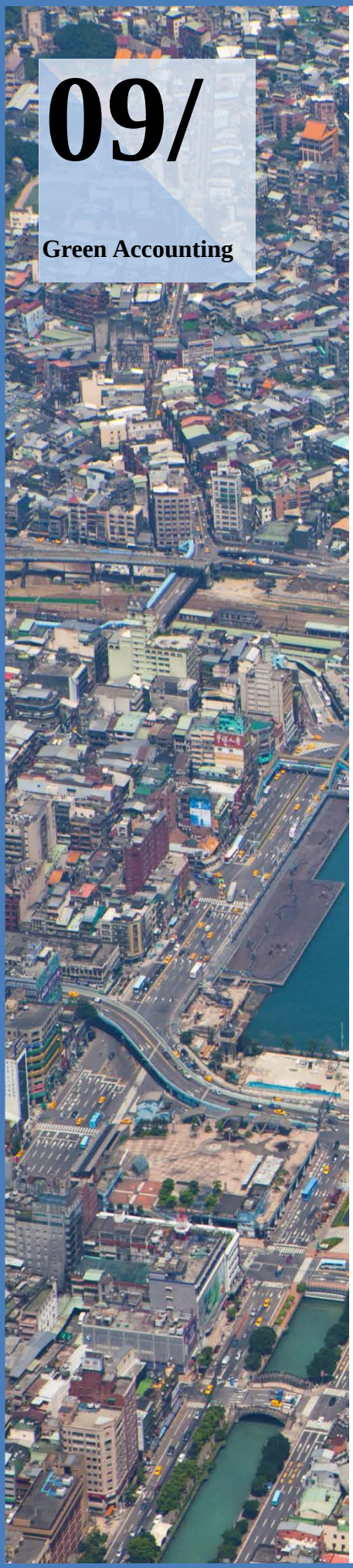
Port of Keelung's First Micro Movie

Sketch of the Port of Keelung


KEELUNG

Green Accounting

09/



09/

Green Accounting

Environmental costs

The investments made by the Port of Keelung, TIPC pertaining to the environmental issues can be primarily divided into employees, environmental maintenance and management, environmental monitoring, publications, and emergency response and communication. The objectives are to improve employee's awareness of the environment, maintain and improve the quality of the port environment, enhance the emergency response capability, and elevate the public's knowledge of the port. All costs are shown as follows:

The total cost expended by the Port of Keelung, TIPC for the environmental issues was NT$ 83,800,000 and NT$ 71,275,000 in 2015 and 2016, respectively, which is approximately €2,287,293 and €1,968,923, respectively.

Environmental investments at the Keelung Port

- Employees: Personnel expenses for those involved in environment-operations education, employee education and training, etc.
- Environmental maintenance and management: Port area greening and landscaping, removing wastes, dredging port berths, etc.
- Environmental monitoring: aspects such as air, nose, water quality, sediment, and dredging as well as environmental inspections
- Emergency response: Costs for accident management at the port area as well as for purchasing pollution removal materials
- Communication and publications: Costs for maintaining websites, holding promotional activities, printing environmental publications, etc.

>>Costs related to Environmental Issues at Keelung Port (Unit: Thousand in NTD)

Items of Expenses	2015	2016
Personnel	31,541	29,073
Environmental Maintenance & Management	48,649	40,135
Environmental Monitoring	986	868
Emergency Response	884	868
Communication & Publication	740	499
Total	82,800	71,275

Environmental Assets

Port of Keelung, Taiwan International Ports Corporation (TIPC) has implemented a series of harbor development projects for Keelung Port to develop into a hub for cross-strait cargo ships and international cruises, Pan-Pacific logistics and distribution center and an environment-friendly green port. These projects can be further divided into development plan and plan for general construction and equipment purchase. Some of them involve environmental issues, such as construction projects that are to newly constructed port area dock facilities; newly constructed Smile pathway to give citizens the opportunity to come closer to the dock; construction of an inspection mechanism system for vessel speed restriction; replacement of gantry cranes to increase work effectiveness and decrease pollutant emission. In 2015and 2016, the respective amounts of fixed-asset investment toward environmental issues made by Port of Keelung TIPC were NT$ 1,186,628,000 and 1,031,867,000, which were approximately €32,779,779 and €28,504,613.

>>Assets invested in Environmental Issues in 2015 (Unit: Thousand in NTD)

Project		Amount
Follow-up Project	Construction project for Keelung Port, Taipei Port, and Suao Port's harbor dock and facility	680,927
	The construction project for the port building in the passenger zone at the west shore of Keelung Port.	243
General building and equipment purchase project		505,468
Total		1,186,628

2015

>>Assets invested in Environmental Issues in 2016 (Unit: Thousand in NTD)

Project		**Amount**
Follow-up Project	Construction project for Keelung Port, Taipei Port, and Suao Port's harbor dock and facility	394,994
General building and equipment purchase project		633,465
合計		1,031,867

2016

Improvement Recommendations

10/

Sustainable operation is vital to Port of Keelung. Because the port adjoins Keelung City, Port of Keelung commits itself to cooperating with the local government and building a solid relationship with the locals to reshape the city into a world-class, ecofriendly port city.

Port of Keelung seeks to emulate the manner in which global ports are operated by diversifying its business based on its core port services while ensuring economic and environmental sustainability and undertaking social responsibility. This enables it to reshape Keelung into a more hospitable port city, enhance the port's reputation, and create a win-win situation for itself and the local government, businesses, and residents.

臺灣港務股份有限公司
基隆港務分公司
PORT OF KEELUNG TAIWAN INTERNATIONAL PORTS CORPORATION, LTD