



# **Green City in Transformation:**

## **Adaptation and Mitigation Actions in Kaohsiung City**

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# ■ World Economic Forum (WEF): 2018 Global Risk Report

## Top 10 Risks to the Global Economy



Weapons of mass destruction



Extreme weather events



Natural disasters



Failure of climate-change mitigation and adaptation



Water crises



Food crises



Biodiversity loss and ecosystem collapse



Large-scale involuntary migration



Cyber-attacks



Spread of infectious diseases





# ■ Climate Change and Disaster Threats in Kaohsiung City



# ■ Frequency of One-Hundred-Year **Extreme Weather Events** in Kaohsiung City

## Typhoon Morakot in Aug. 2009

- Severe floods in the central and southern Taiwan from Aug. 6-10
- A catastrophic damage happened in Xiaolin Village of Jiaxian District
- **702 people died**, 22 people missed, 4 people seriously injured, and agricultural losses exceeded NT 520 million.

## Typhoon Fannaby in Sept. 2010

- On Sept. 19, Nanzih area with a total rainfall of 618 mm, **approaching the two-hundred-year rainfall frequency**.
- 2 people died, 111 injured, the loss of agriculture and fisheries in Taiwan exceeded NT109 million.

## Typhoon Megi in Sept. 2016

- On Sept. 19, **the daily rainfall in mountain area exceeded 500 mm**.
- 4 people died, 662 injured, the loss of agriculture and forest exceeded NT 9.52 million.



Extremely torrential rain  
higher than 500 mm/day

2009

2010

2016

2018

The daily rainfall was  
over **1000 mm**  
ranked the highest in the  
world

The biggest disaster for the  
past 50 years in Kaohsiung



## Floods in August 2018 (August 23-28)

- The daily rainfall in the city center was 210 mm, **and the instantaneous rainfall was higher than 100 mm/hr**.
- **The most severe urban storms in Taiwan after the typhoon Morakot.**
- 100-year frequency storm.

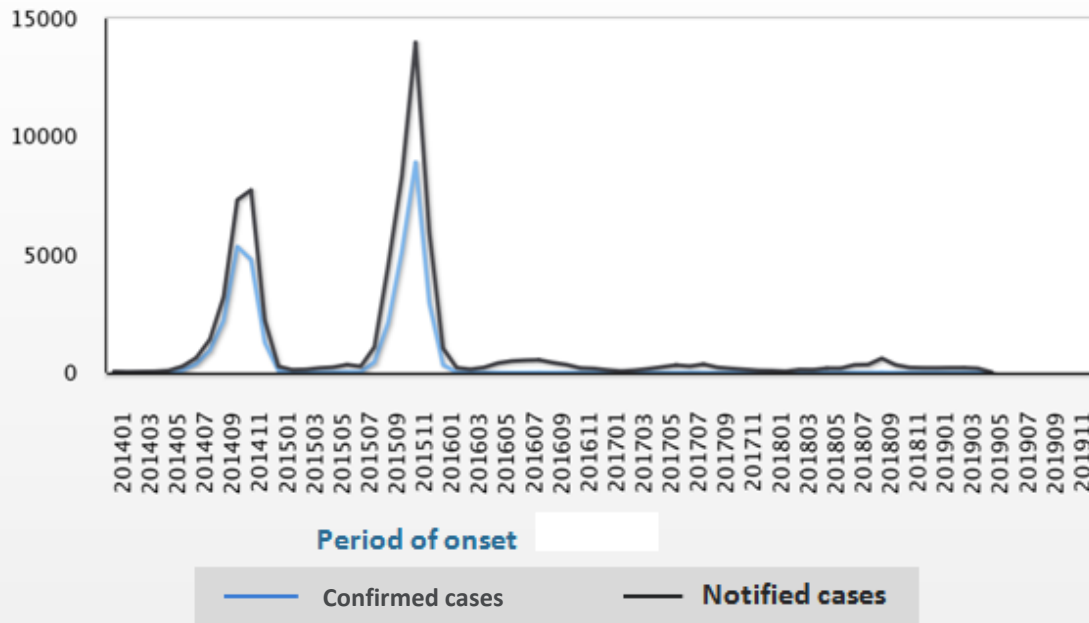


# ■ Dengue Fever: Current Status and Challenges

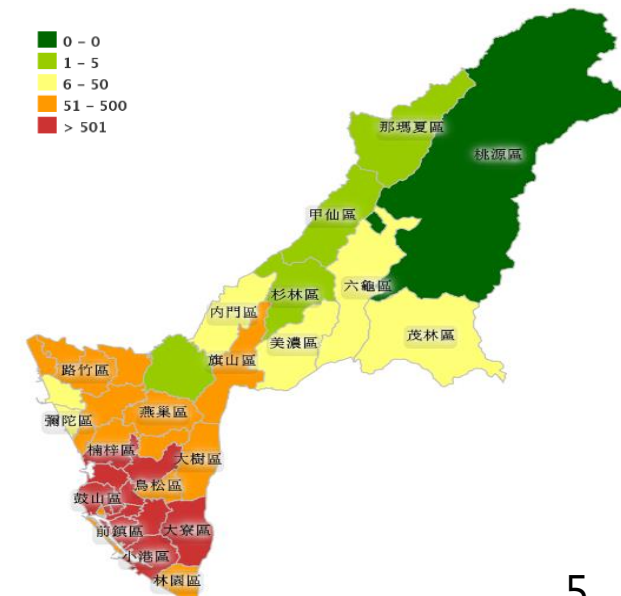
Year	2014	2015	2016	2017	2018	2019/1-9
Confirmed cases	15,043	19,784	379	37	56	102
Domestic cases	14,999	19,723	342	3	12	<b>57</b>
Overseas cases	44	61	37	34	44	45
Death toll	20	<b>112</b>	4	0	0	0
Mortality rate	0.13	0.57	1.06	0	0	0



Dengue cases in Kaohsiung City (2014/01-2018/05)



Spatial distribution of dengue fever cases in Kaohsiung City



# Highlights on Carbon Reduction and Adaptation Actions





# Transforming Cities for Resilience & Safety

## □ Resilient City under the Definition of ICLEI

• **I.C.L.E.I** Local Governments for Sustainability

**Resilient City** : A resilient city is defined as a city of low risk to natural and man-made disasters. It reduces its vulnerability by building on its capacity to respond to climate change challenges, natural disasters, and economic shocks.



# ■ Transitioning towards a Sponge City

## □ Green Building and Sponge City

- Enacting “**Green Building Autonomy Act**”
- Regulations for designing and rewarding **Kaohsiung LOHAS Building**



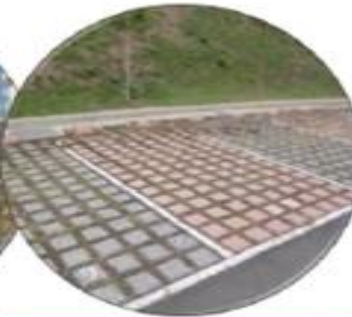
Water Butt



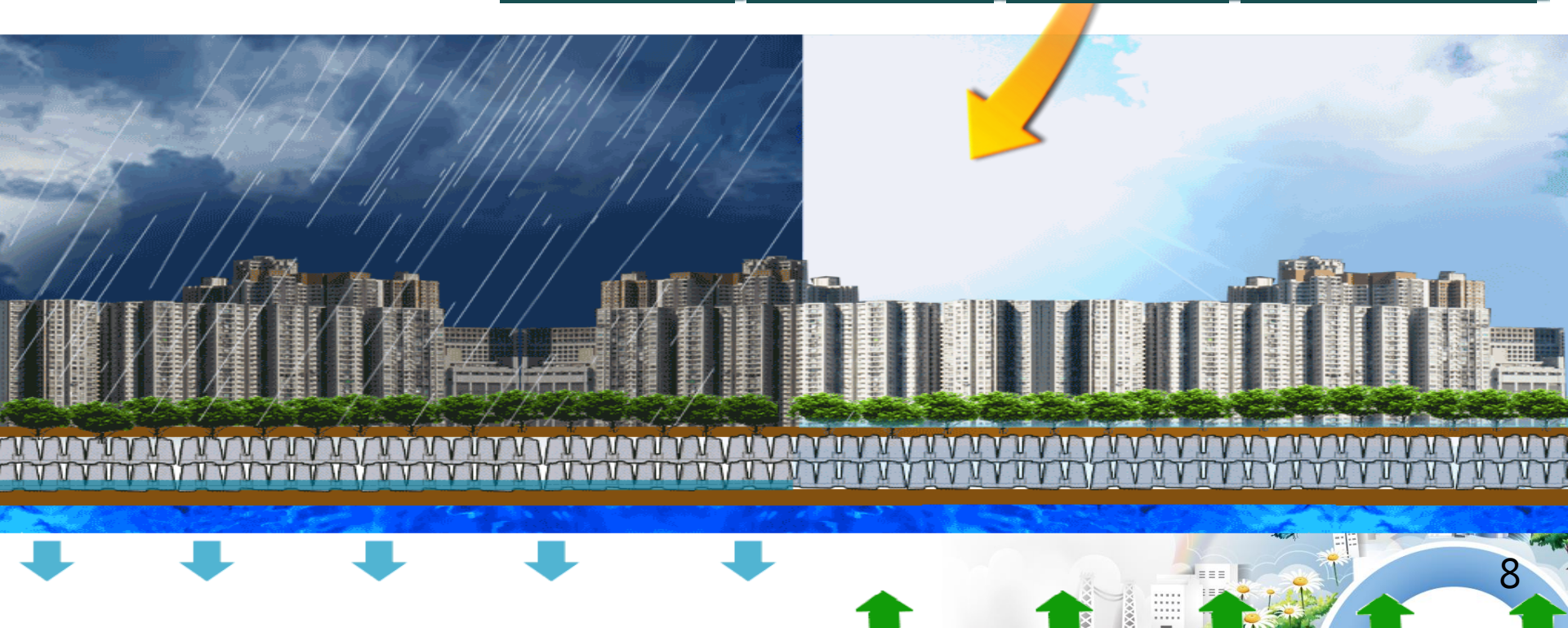
Rain Garden



Green Roof



Permeable  
Pavement





# ■ Transitioning towards a Sponge City

## ▣ Widely Constructed Flood Detention Ponds

- Kaohsiung City has constructed **13 flood detention ponds** by 2018, with a total of flood storage capacity of **2.956 million tons**. The area has increased from 639 to 958 hectares.
- Currently, the overall flooded area has been **decreased by about 6,352 hectares** while compared to the flooded area prior to its merger with Kaohsiung County. The amount of flood detention is the highest in the country, creating a sustainable city.

**Chai Shan Flood Detention Pond** was constructed in 2017 and won the **Executive Yuan 17th Gold Medal for public constructions**.

**Benheli Flood Detention Pond** was built in 2005 to become the **first urban flood control detention pond in Taiwan**.



# ■ Transitioning towards a Sponge City

## □ Widely Built Constructed Wetlands

An **blue belt** eco-system water management

- **21 wetlands** in the city
- Over 1,000 hectares





# ■ Transitioning towards a Sponge City

## Engineering Improvement Project

The flooding area **reduced from 15 to 5 ha** after constructing Chia-Shan flood detention pond.

### Before the construction of Chai Shan Flood Detention Pond



**Sept. 15<sup>th</sup> 2016**  
*Typhoon Merandi*  
Severe Flooding in  
Jiuru Land Bridge &  
Gushan 3<sup>rd</sup> Rd.



### After the construction of Chai Shan Flood Detention Pond



**Aug. 23<sup>rd</sup> 2018**  
*Extremely heavy rain*  
fell on Jiuru Land  
Bridge & Gushan 3<sup>rd</sup> Rd.  
The Chai Shan Flood  
Detention Pond was  
proven to be effective  
for stormwater.

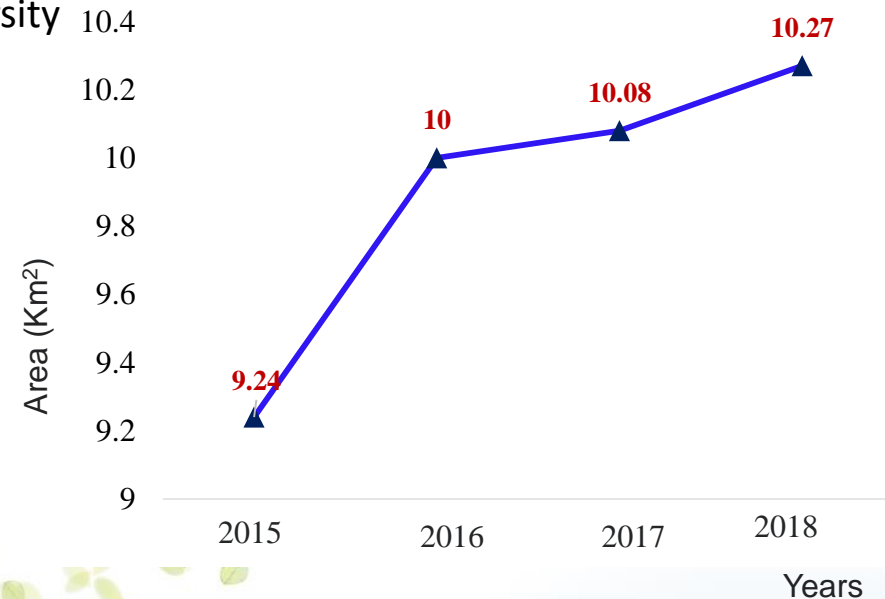


# ■ Transitioning towards a Sponge City

## □ Green Spaces and Parks

- Providing citizens the best leisure places
- Improving living quality and environments
- Improving climate change, air pollution, biodiversity
- Creating a modern cosmopolitan landscape
- Transforming the harbor city into a humanized and ecological garden city

With the highest percentage of public green space within 6 municipalities in 2018



Green space for people in urban areas



Linyuan Daan Jade Park No.2



Fengshan Sports Park



# ■ Promoting the Green Roof Project

## □ Green Building Autonomy Act

- Green building is designed for energy conservation and disaster prevention.
- Priority specification for public, large-scale development, and high-pollution construction
- Achieve the goal of **energy conservation, carbon reduction**, and **urban transformation**
- **Carbon reduction is about 5,800 tons/yr, and water saving is 380,000 tons/yr.**



Solar photovoltaic facility



Roof insulation



High efficiency & energy saving T5 lamps



Kaohsiung LOHAS Building



### Green Building Autonomy Act

- 1) Solar photovoltaic, greening, and heat insulation
- 2) Water-saving toilets, rainwater recovery and storage facilities
- 3) Green building materials
- 4) Construction waste management & disposal
- 5) Affinity fence installing
- 6) Bicycle facilities design for buildings

# Promoting the Green Roof Project

Kaohsiung's geographical environment is suitable for setting up solar photovoltaic

Kaohsiung City is located in southern Taiwan, with sufficient sunshine and an average of 2,100 to 2,300 hours of sunshine per year.



## Clean Energy

Constructing of 350 MW solar photovoltaic facilities



## Economy

Creating \$1.1 billion economic benefits for green energy industry



## Intelligence

Establishing 200 smart green energy systems for public school buildings

2015

*The First Phase*

2018

2019

*The Second Phase*

2022

- The installed capacity is 293.94 MWP
- With an average household of 450 kWh/month, the total amount of power generation can provide the electrical usage of 64,000 households per month.

## Target

- Set up 350 MW in the second phase
- Power generation is 447 million kWh/yr
- Carbon reduction is 236,500 tons/yr



As Taiwan move toward a nuclear-free homeland in 2030, every household in Kaohsiung City will be equipped with solar photovoltaic facilities. Thus, the whole city could supply energy by itself.



Nanzhi District Office - photoelectric facilities set up in public buildings



# ■ Developing Sustainable Transport

## ■ Approaches/Goals

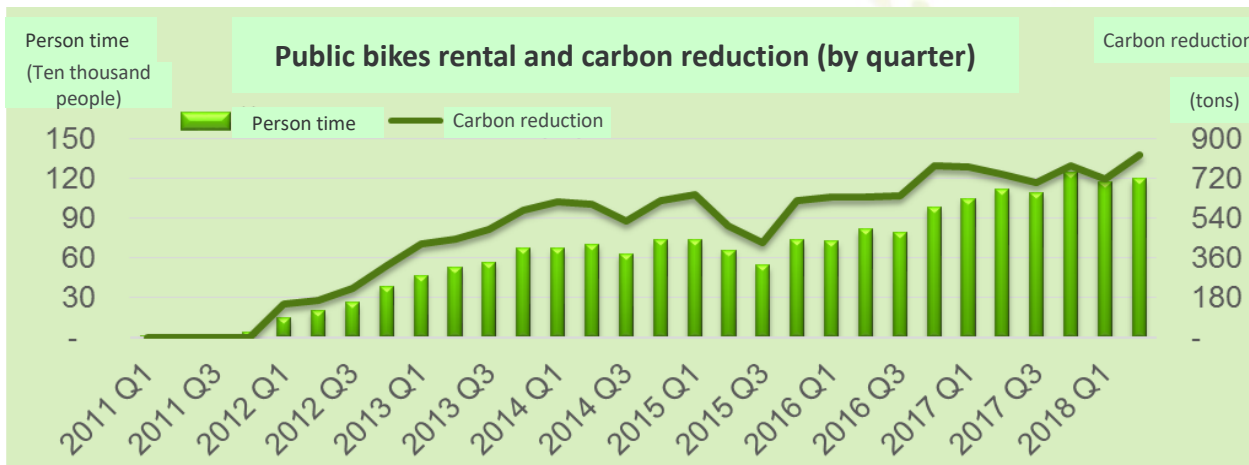
- Set up Public Bike Rental System (C-Bike).
- Reduce the use of private transport and reduce carbon dioxide emissions.

## ■ Outcomes

- The C-Bike rental station has been expanded up to 300. It is expected to set up 100 stations from 2019 to 2021.
- In 2017, the reduction of CO<sub>2</sub> emissions was about 80 tons, equivalent to reducing the emissions of 1,000 heavy-duty diesel trucks or 129,500 four-stroke scooters.
- From 2011 to 2018, the cumulative carbon reduction was about 14,700 tons, equivalent to the annual carbon absorption of 6.7 Kaohsiung Metropolitan Park.
- Kaohsiung has more than 1,030-kilometer cycle network.



**Public Bike Rental Station**



**Connect Metro Station & Public Bike**

# ■ Developing Sustainable Transport

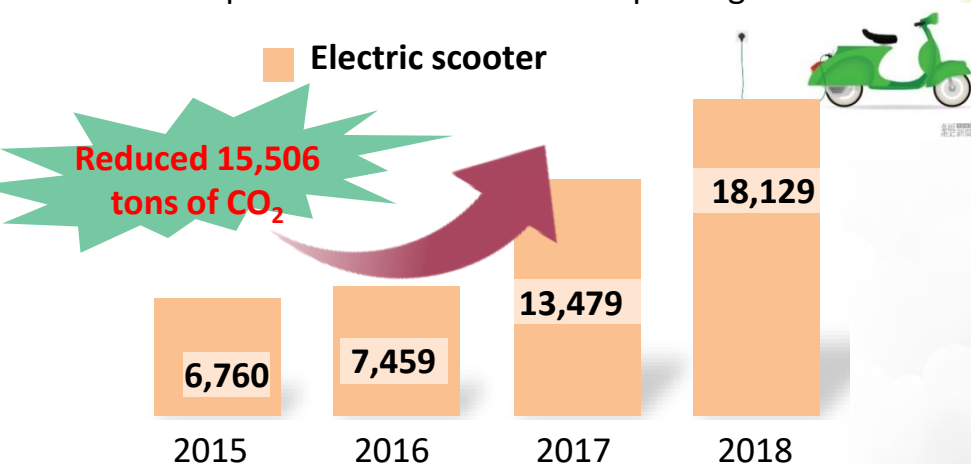
## Promote the use of *electric scooters*

### ■ Vision

- In order to promote green transportation and reduce GHG emissions from scooters, Kaohsiung City Government **provides subsidies for the purchase of electric vehicles and free charging station services.**
- By updating the system, **the subsidy remittance period is effectively shortened**, thus people's willing to purchase electric vehicles is enhanced.

### ■ Current Outcomes

- Completed the setup of **138 public electric scooter charging stations.**
- The pilot operation will be held for 2 years from July 1, 2018. The electric scooters can **park with free charge** on public roads and on-street parking lots.



## Promote the use of *electric buses*

### ■ Goals



By 2030, the share of electric buses is expected to reach 100% in Kaohsiung.

### ■ Approaches/Achievements

- Kaohsiung now has the largest electric bus fleet in Taiwan.

Reduced 2,921 tons of CO<sub>2</sub>

- ✓ Subsidize old for new  
Replace **75** diesel buses every year

- ✓ New route planning  
Buy in **5** electric buses per year

- ✓ Highest achievement in Taiwan  
The total number of electric buses reached **109** as of January 2019.

**109** electric buses have been launched until January 2019, accounting for **10.8%** of the city's 1,010 buses.



# EcoMobility World Festival

- Practice indicators: carbon reduction, lightweight vehicles and ecomobility community
- Five major transportation facilities

用綠發動哈瑪星  
*Going Green in Hamasen*

Over 43 countries, 50 cities, 23 mayors and 1,200 delegates participated in the event.

## Kaohsiung Strategies



The overall improvement of the pedestrian crossings.

50 enterprises participated  
80 indoor & outdoor booths

**More than 150 events**  
**More than 300,000**  
**participants**

Electrical Buses

Electrical vehicles

# GHG Emissions in Kaohsiung City

**13.2% Lower** than the Base Year



Based on the "Greenhouse Gas Reduction and Management Act"

**Long-term Goals**

Base Year (2005)



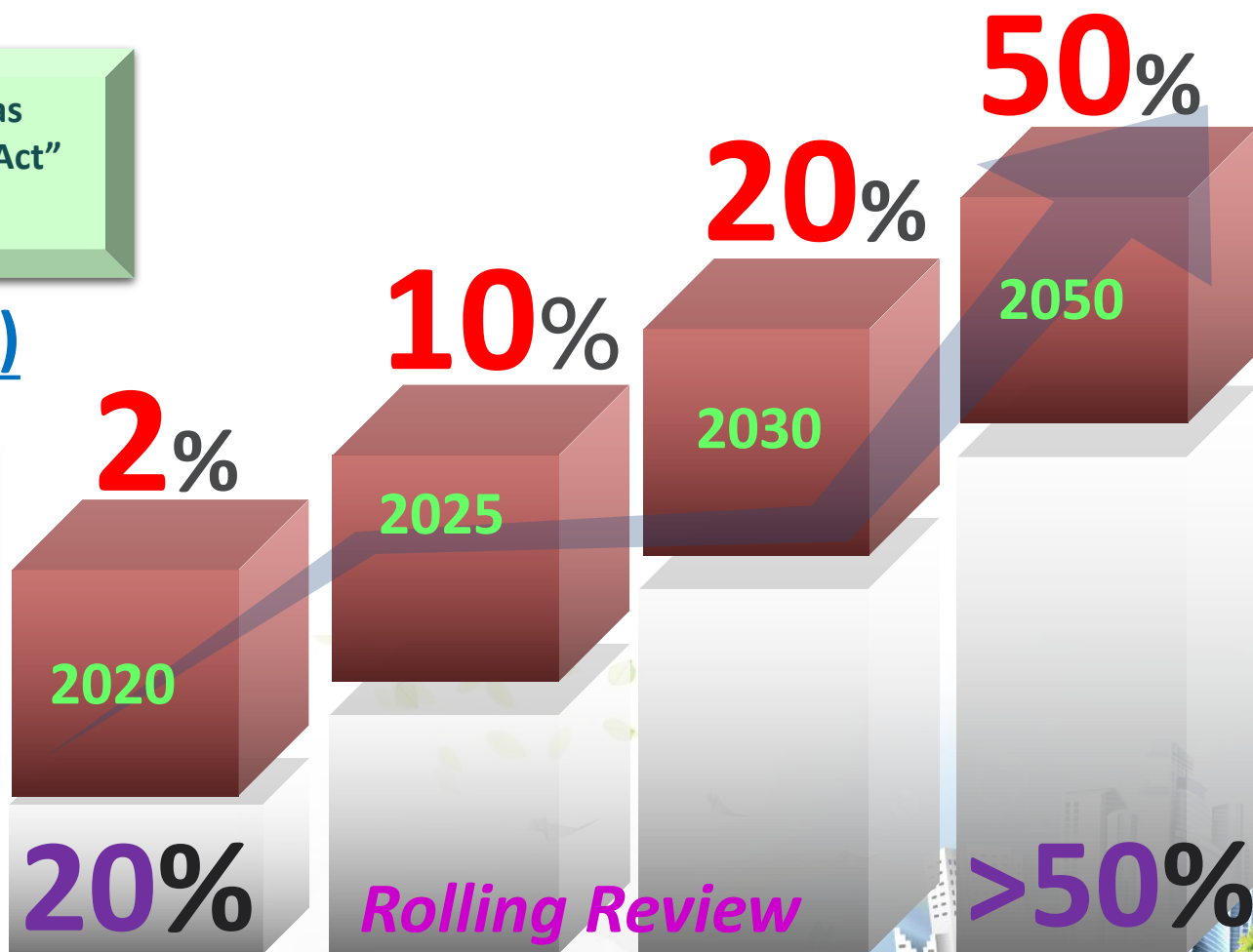
2017

**13.2%**

**20%**

*Rolling Review*

**>50%**





# ■ Tackling the Threat of Dengue Fever

## *Inter-Departmental Action Plan / Environmental Self-Management*

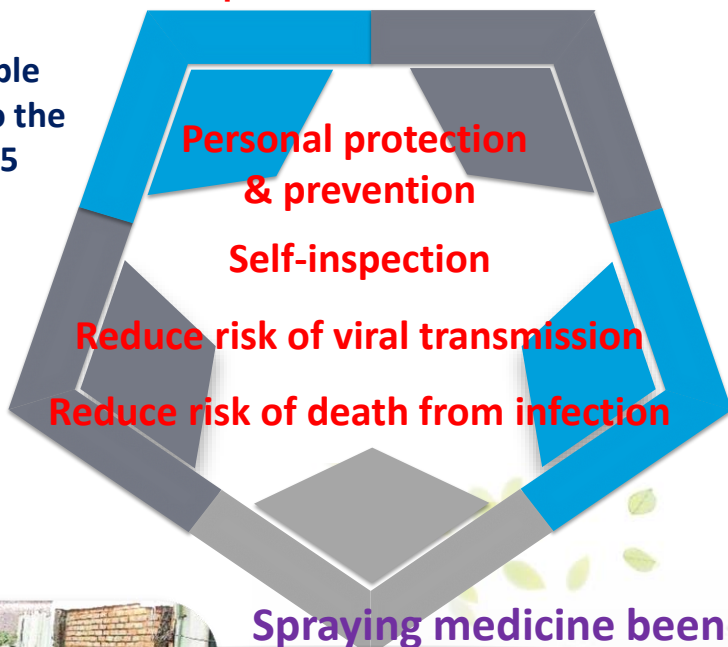
### Tackling the epidemic across country borders

#### 【Department of Health】

- In order to prevent infection with dengue virus from travelling, people need to take the initiative to go to the health clinic for blood test within 5 days after returning home.



### Measures for epidemic control



### Community involvement in dengue outbreak control

#### 【Civil Affairs Bureau】

- The reward program of neighborhood self-supporting dengue prevention work in high-risk areas.



### Spraying medicine been replaced by mandatory inspection of breeding sources

#### 【Environmental Protection Bureau】

- Dengue fever ecological anti-mosquito program.
- Handling the events of “Eliminating dengue fever mosquito breeding source”





# ICLEI KCC Achievements 2012-



## Actively host international events to improve our international visibility

- Participate in ICLEI World Congress
- Host Intl. Forum on Industrial Pipeline Management
- Host workshops on Carbon Disclosure Inventory workshops in Taiwan
- Host ICEO&SI\*ICLEI Resilience Forum
- Host forums and workshops on EcoMobility
- Participate in UNFCCC COP21、COP22
- Support Kaohsiung to fulfill the EcoMobility Alliance Chair Tasks 2016-2018

Intl.  
Participation  
& Exchanges

**50 +**

Capacity  
Building on  
Sustainability

**60+** events  
**1500+** Ppl.

Equipped with in-depth  
professional capacity and  
knowledge outputs

**Start-Up Period  
2012-14**

**Development Period  
2015-16**

**Accelerating Period  
2017-18**

**Deep-diving Period  
2019-21**

## Member recruitment and business start

- Establishment of ICLEI KCC
- Mentor city partnership project
- Participate in Metropolitan Solutions @Hannover Messe
- Host DRR Forum and ICLEI GexCom Meeting
- Host LAB Conference



## Renewal of ICLEI KCC Host Agreement & Cohost EcoMobility Global Congress

- Renewal of ICLEI KCC Host Agreement
- Cohost EcoMobility World Festival & World Congress
- Participate in EcoMobility Days at UN HABITAT III
- Host more than 20 training programs and peer learning courses for cities on resilient cities, smart water, SDGs, EcoMobility, Renewable and so on
- Assist Taiwan City Delegation at ICLEI World Congress



Congrès mondial ICLEI  
ICLEI World Congress 2018  
19 au 22 juin - 19 - 22 June - Montréal, Canada

**ICLEI Resilient Cities Series @ Bonn  
COP Cities and Regions Pavilion**







# *A Future Vision of Kaohsiung*

安全 健康 宜居城市

*Safety, Health, and Livable City*

# Thank You for Your Attention

*carbon reduction*

*temperature control*

*adaptation*

*adapt to the environment*





# Outlines

01

Climate Change Impacts on Global and Local Kaohsiung Environment

02

Highlights on Carbon Reduction and Adaptation Actions

# Climate Change Impacts on Global and Local Kaohsiung Environment





#### 4. Man-made Disaster Threat in Kaohsiung City (Gas Pipeline Explosions)

- ▶ Venue: Cianjhen and Lingya District, Kaohsiung City
- ▶ Time : 31 Jul. 2014 at 21:00 - 1 Aug. 2014 before dawn





# Impacts of Gas Pipeline Explosions

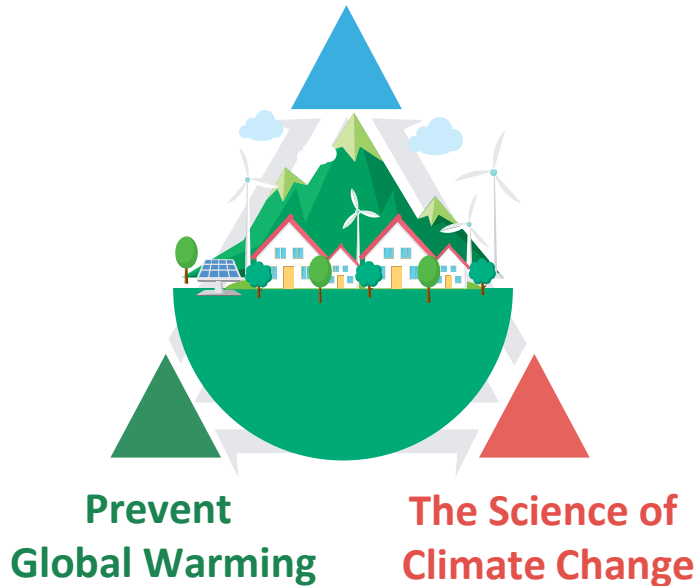


- ❑ Caused by the managing flaw of the propylene transportation
- ❑ Restricted zone covers **4 km** long and **7.2 km<sup>2</sup>**
- ❑ **32 were killed and over 300 others were wounded**



# Highlights on Carbon Reduction and Adaptation Actions

## Impacts & Adaptation



*1. Transitioning towards a Sponge City*

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*2. Promoting the Green Roof Project*

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*3. Tackling the Threat of Dengue Fever*

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*4. Disaster Management and Notification  
for Industrial Pipeline*

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*5. Developing Sustainable Transport*

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# 4. Disaster Management and Notification for Industrial Pipeline

## Comprehensive review and analysis of pipes for petrochemical industry in Kaohsiung

- High density steel industry distribution
- 57 most dangerous petrochemical industrial plants
- 800 steel fastener manufacturers
- 7 large industrial parks
- Widely distributed shipyards and container handling areas
- Concentrated power supply is greater than five major public investments, such as the construction of light rail

### Safe City Transformation Response Strategy after Gas Explosion

#### Challenge

#### Countermeasure

Fuzzy zone of authority and responsibility

Disaster prevention mechanism

Unable to source

Pipeline management specification

Composite material pipeline material

Update pipeline management specification

Lack of emergency shut-off valve

Site inspection system

### Kaohsiung City Road Excavation Management Center Road Excavation Information and Inspection Report

全部案件

匯取年月：民國 108 年 03 月

高雄市 108 年 03 月 道路挖挖修復總表

機關別	修護資訊來源(件)				緊急修復完竣時間(週)					輸入者資訊		
	其他機關	自行	總數		4小時	24小時	48小時	72小時	總數	填表人	填表人單位聯絡電話	填表日期
通報	轉知	巡查	(件)	以內	以內	以內	以上	(座)				
水利局	21	5	16	42	42							108/04/03
農工處四處農工工程處	41	17	802	860	843							108/04/03
農工處農山漁業工程處	47	22	790	859	824							108/04/02
農工處農山漁業工程處	10	6	692	708	690							108/04/02
農工處農山漁業工程處	18	10	569	597	585							108/04/01

機關別：本府水利局

請輸入填表人資訊

填表人：

聯絡電話：

※需輸入填表人資訊才可進行通報！

確定

號

1 2 3 4 5 下5頁

Cause of Construction	Permit Number	Duration
自來水管線路面漏水搶修 (本案於108年3月26日 09:00前鎮分局一心路派出所備案不受理民權派出所在通報單蓋圓型章)	W10800962	從 1080326 至 1080326
配合水利局排水改善工程	T10800451	從 1080426 至 1080509
舊有建築用戶需要用水(僅申請自來水)	W10800969	從 1080425 至 1080502
遷移(管路與過路側溝抵觸)工程	E10800978	從 1080425 至 1080508

1080423	高雄市政府	台灣電力股份有限公司鳳山區營業處	鳳山區	市區道路 縣衙里曹公路與光遠路口、三民街30號 (78M)
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