Strategies for Clean Air and Bright Sky in Tainan

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Outlines

01 Introduction of Tainan city

02 Major Air Pollution Control Strategies

03 The Results of Air Quality Improvement



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Where is Tainan City?



Area : 2,191 km² Population : 1,880,000



Environmental Load



Three Issues of Air Pollution



Influence of Meteorology on Air Quality

Meteorology and topographical factors lead to pollutant retention. Vehicle Exhaust Pollution

- Total vehicles is 1.98 million.
- 1.05 vehicles per citizen.





Traditional Activity and Agricultural Pollution

- •Total temples are over 2000.
- •Joss paper and incense sticks burning.
- •Agricultural waste burning.

Influence of Meteorology on Air Quality



CMAQOP1.0 Init: 2018-01-03 00(UTC) Valid: 2018-01-04 01(UTC)

PM2.5 (ug/m3) Wind (m s-1)



OUTPUT FROM WRF V3.3.1 MODEL, CWB ver.: CMAQWRF WE = 109 ; SN = 163 ; Levels = 25 ; Dis = 3km ; Phys Opt = 7 ; PBL Opt = 1 ; Cu Opt = 0

Topographical and Pollution

Northeast monsoon blows during fall to spring.
Located on the leeward side and the weak wind tail zone.
Pollutants are difficult to diffuse.







The Major PM_{2.5} Sources

Primary PM_{2.5}

Secondary PM_{2.5}



02 Major Air Pollution Control Strategies



Clear & Bright Sky Plan

■Tainan city started "Clear and Bright Sky – Particulate Matter Reduction Control Action Plan" in 2014.

18 bureaus of Tainan city worked together to promote **9 strategies** and **50 items** in 2018.



Methods of Factory Control

Control Sources of Pollution-Use less toxic raw materials or fuels
 Economic Incentives-Air Pollution Control Fees
 Enhance Control Technology/Equipment

-IBACT(Individual Best Available Control Technology)

-BARCT(Best Available Retrofit Control Technology)



Incentives for Emission Reduction

The aim is reducing the unhealth of air quality.Reduction plan and incentives of reduction fall to spring.



Air Quality Monitoring Equipment

4The density of air quality monitoring device is 2.1 km²



Vehicle Exhaust Background

41.05 vehicles per person in Tainan.

▲Produced 17,338 tons of NOx emission and 1,622 tons of PM_{2.5} yearly.



Emission Controls on Scooter



Decreasing Two-stroke Scooter and Increasing E-Scooter

Two-stroke scooters were decreased by 350 thousand vehicles in 7 years.

Electric scooters were increased more than 33,652 in 7 years.





Emission Controls on Diesel Vehicles



E-Vehicles Schedule







Traditional Activity

Pollutions from cultural activities

Tainan has the most temples in Taiwan (more than 700 temple fairs every year).



Pollutants from Joss Paper



Pollutants from Incense Sticks



Pollutants from Firecrackers



Emission Controls on Joss paper

Donating Money Instead of Purchasing Joss Paper



Incineration just for Joss Paper



Transported **9,102** tons in the last eight years. Reducing **30** tons of **TSP** emission from burning joss paper and incense sticks during 2011 to 2018.



Agricultural Waste

Solving waste pollution from agriculture

- Producing 150 thousand tons of rice straw and 2,800 tons of waste shells every year.
- ▲After harvest, lots of waste will be produced and burned causing air pollution.



Burning Waste Rice Straw

Waste Water-caltrop Shells



Straw Blankets



It can improve **soil infertility, fertilize land**, help agricultural resources recycling and reduce waste of natural resource.

Process

Recycled waste is used in additional processes as new products, such as straw blankets to cover the bare surface, or the water-caltrop shells into incense sticks.

Reuse

Waste reuse, such as straw stalks directly cover the orchard.



Circular Economy - Biochar

- In Tainan, producing 2,100 tons of waste shells every year. However farmers usually throw or burn it in the open field.
- Interfore, making the waste shells into biochar and using in variety of products.









03 The Results of Air Quality Improvement

Reduce PM₁₀ and PM_{2.5}

PM_{10}

Reached to air quality standard for 4 years. PM₁₀ annual average decreased by 24% PM₁₀ daily average decreased by 29%



PM_{2.5}

PM_{2.5} annual average decreased by 34% PM_{2.5} daily average decreased by 31%



The Goal

Increase the day of blue sky

Reduce the day of "unhealthy" air



2019 26

30

36

25

2018



Conclusion

We are Breathing the Same Air









