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Feature Article

Mitigation Measures Implemented to Establish a Low Carbon, Sustainable Homeland

To join efforts with the local governments to cut down carbon emissions, the EPA has already approved the greenhouse gas control implementation plans of 22 municipalities, counties, and cities. Besides the launch of the low-carbon certification and rating mechanism, another major move is to combine both the public and private sectors by utilizing subsidization and auditing mechanism in order to respond to climate change and establish a low carbon and sustainable homeland.

Strategies for carbon reduction actions

Since the promulgation of the *Greenhouse Gas Reduction and Management Act* (溫室氣體減量及管理法) on 1 July 2015, the EPA has in accordance formulated 12 sub-laws involving detailed regulations, inventory, verification management, and trading programs. Other than eight administrative regulations that were issued, there are also rewarding and

subsidization regulations, with emission source efficiency standards as well as a voluntary reduction incentive mechanism in place, to motivate enterprises to reduce emission. Meanwhile, the EPA has set the basic directions for mitigation and adaptation by formulating the *National Climate Change Action Guidelines* (國家因應氣候變遷行動綱領) and the *Greenhouse Gas Reduction Promotion Program* (溫

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室氣體減量推動方案)。Meanwhile, the *Greenhouse Gas Emission Control Action Plan* (溫室氣體排放管制行動方案) was set, covering six major departments, which are energy, manufacturing, transportation, residential and commercial, agricultural, and environmental sectors.

The key points of the plan include promoting energy transformation, expanding the ratio of renewable energy in power generation, assisting industries in green, low-carbon transformation, and developing green transportation and promoting low-carbon vehicles. Also, enhancing the baseline standards of the energy conservation design for the new buildings' outer parts, helping animal farms in marsh gas recycling, and enhancing methane recycling in waste landfills and industrial wastewater. The greenhouse gas control goals for each stage have been set with reduction measures in these government agencies, effectively drawing a complete blueprint of the national carbon reduction strategy.

After the *Greenhouse Gas Reduction Promotion Program* was approved, the EPA immediately invited central competent authorities to assist 22 municipality, county, and city governments to formulate the greenhouse gas control programs suitable for each respective jurisdiction. The programs were all approved on August 2019. The entire central government has thus come together to implement locally tailored climate actions.

Promoting the greenhouse gas inventory, registration and offset programs

With a baseline of greenhouse gas emission in place, a total of 294 enterprises had been put under control in 2018, allowing the EPA to track 85.5% of direct emission of Taiwan's industrial and energy sectors.

The greenhouse gas offset program allows more enterprises to participate in carbon reduction. There were 86 applications to register for the offset program as of November 2019, and 43 have been



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Definition of Low carbon and Sustainable Homeland

Based on the vision for sustainable development, the Low Carbon City is a city designed with consideration of economic growth, environment protection, ecology conservation, social justice, and the relevant policies to reduce carbon emission, ensure the safety of energy supply, as ...



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Activity

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▲ The website of the Low Carbon and Sustainable Homeland (<https://lcss.epa.gov.tw/en/default.aspx>) discloses reduction measures implemented in neighborhoods/villages, towns, and regional governments.

approved and are expected to cut down 4,108 metric tons of CO₂e. Moreover, a micro-scale offset program (no more than 20,000 metric tons in annual reduction) is set to lower application threshold in order to encourage medium and small businesses to participate. Registration forms and auditing procedure are simplified, and demonstration cases are also promoted as references.

Public and private sectors joining efforts to combat climate change

(1) Public and private sectors tackling climate change together

The central government has been collaborating with local governments and civil organizations to jointly promote climate change mitigation. With subsidizing and auditing mechanisms in place, grants were approved in 2019 for 22 local governments (over NT\$181,280,000 in total) as well as 71 civil organizations to raise the sustainable, low-carbon awareness in the society.

(2) Promoting a low carbon and sustainable homeland

To raise local governments' capacity to respond to climate change, the EPA has announced the *Low Carbon and Sustainable Homeland Rating Promotion Program* (低碳永續家園評等推動計畫). Neighborhoods, villages, townships, municipalities, counties, and cities have been actively encouraged and assisted to take part. By the end of September 2019, there had been 22 local governments, 339 towns (92% of all 368 in Taiwan), and 4,108 villages and neighborhoods (53% of all 7,760 in Taiwan) that signed up for the program. After evaluation, those certified with silver rating included 52 villages and neighborhoods, 12 towns and cities, and 9 municipalities, counties and cities, and those with bronze rating included 794 villages and neighborhoods, 114 towns, and 11 municipalities, counties and cities.

A low-carbon and sustainable homeland is a vital

part of localizing carbon reduction actions and enhancing communities' adapting capacity. Since implementation, the public has become more aware of climate change. Moreover, the biggest change is shaping low-carbon environments. Participants have now become highly aware, recognizing the importance of energy conservation and carbon reduction, and thus begun to commit to carbon reduction in their daily behaviors. Compared with 2017, the average energy conservation in 2018 is 6.15 kWh/person in Taiwan. The energy conservation achievements in 2018 is 20.85 kWh/person for villages and neighborhoods of bronze rating and 24.44 kWh/person for those of silver rating, which is four times the national average. In total, the villages and neighborhoods in silver and bronze ratings have save 6,958 kWh in 2018, compared with 2017, which is the equivalent of reducing 37,087 metric tons of CO₂e.

Climate change mitigation

Based on the *Greenhouse Gas Reduction and Management Act*, the EPA took reference of the National Development Council's achievements of the *National Climate Change Mitigation Action Plans* (2013-2017) and mapped the future climate change mitigation tasks. After multiple cross-department discussions, the draft of the *National Climate Change Mitigation Action Plans* (till 2022) was submitted to the Executive Yuan on 7 May and then approved on 9 September 2019.

Future perspective

In combating climate change, adaptation requires more involvement of all sectors than mitigation. As a result, the EPA will collect and evaluate each department's reduction and adaptation results based on the *Greenhouse Gas Reduction and Management Act*. The EPA will also gradually help local governments to form localized reduction strategies and revise them regularly, promoting sustainable social, economic, and environmental development in Taiwan.

Other than being an important policy for Taiwan at this stage, carbon emission reduction is also what citizens need and expect. This is a great responsibility by which

the EPA always sets great store and hence will keep working hard to reduce greenhouse gas emissions and improve air quality.

Sustainable Development

Promoting Marine Protection at the APEC Marine Environment Sustainability Meeting

On 2-3 October, the EPA held the 20th APEC Roundtable Meeting on the Involvement of Business/Private Sector in Sustainability of the Marine Environment. Representatives of APEC members, academia, enterprises, and NGOs from home and abroad all came together to discuss issues on conservation of the marine environment and resources, including (1) marine pollution prevention and (2) ocean energy and technology. The event promoted collaboration between public and private sectors to ensure the sustainable development of the marine environment and resources.

APEC is an important international organization in which Taiwan participates. Strengthening public-private sector partnership and involving business and the private sector have always been APEC's basic policies as reflected in past leader and ministerial meetings. For instance, there had been similar calls in the Seoul Declaration, Bali Action Plan, Paracas Declaration, and Xiamen Declaration during marine ministerial meetings in 2002, 2005, 2010, and 2014. Responding to this policy, the EPA has organized 19 APEC roundtable meetings to date.

Government officials, NGO and business representatives, and experts from five APEC members (Indonesia, Japan, Korea, the US and Taiwan) took part in this year's meeting. They discussed marine pollution prevention and ocean energy and technology, the two main themes of the meeting. The purpose was to intensify collaboration between governments and business and private sectors to protect the marine environment and ensure sustainable resource use.



▲ The 20th APEC Roundtable Meeting on the Involvement of Business/Private Sector in Sustainability of the Marine Environment

There were 16 keynote speakers giving speeches on the use of automatic identification system (AIS) to lower vessel emission's impact on air quality, establishment of a mechanism to prevent marine pollution caused by vessels' oil leakage, and the reduction of vessels' plastic waste. Other topics included marine waste reduction and monitoring,

marine energy development, development and use of marine renewable energy, and wind power. All suggestions summarized at the conclusion of the meeting will be provided to the 2020 meeting of APEC Oceans and Fisheries Working Group (OFEG) for reference.

Air

Boiler Improvements Effectively Cut Down Air Pollution

Implementing the *Air Pollution Prevention Action Plan* (空氣污染防制行動方案), the EPA and the Ministry of Economic Affairs (MOEA) have promoted boiler improvements via subsidization or diverse assistance programs. By the end of October 2019, 1,970 industrial boilers and 1,180 commercial ones had been improved, achieving 94% and 147.5% of the goals, respectively. The MOEA has been in charge of the industrial boiler improvements, while the EPA the commercial ones. With the assistance from the local environmental bureaus, fully achieving the goals will result in reducing emission of 3,900 metric tons of sulfur oxide, 1,700 metric tons of nitrogen oxide, and 360 metric tons of particulate matter annually.

To expedite the phasing out of boilers and strengthen pollution emission reduction, the EPA has employed regulatory control and subsidization at the same time. The *Boiler Air Pollutant Emission Standards* (鍋爐空氣污染物排放標準) announced by the EPA on 19 September 2018 requires existing boilers to comply by 1 July 2020, aiming to encourage businesses using boilers to take preventative and control actions. Besides switching to natural gas for fuel, businesses can also improve air quality by working on the fuel source, burning technology, and pollution control.

To allow longer time for the improvement of existing boilers when it needs, the standards stipulate that the compliance deadline can be extended for two years (allowing the improvement to be completed no later than 1 July 2022). The EPA reminds that enterprises needing the extension to submit the application for extension with proposed air pollution prevention and control plans to the competent authorities in municipalities, counties, and cities before 1 April 2020 as required by the regulation.

In addition, both the EPA and the MOEA allocated budgets to subsidize boiler improvement or assist enterprises by examining boilers on-site and providing suggestions on burning technology and pollution control measures. To encourage enterprises to carry out improvement and lessen the impact on the industry, the MOEA has set up a platform for better

coordination among industrial boiler users, relevant government agencies, and natural gas suppliers. Via this platform, enterprises can highlight the difficulties they face in carrying out improvements, such as high construction costs, to the relevant offices in order to find the solution.

Moreover, the Industry Development Bureau of the MOEA has intensified efforts in assisting the enterprises in the industrial parks under its jurisdiction. So far 1,502 boilers, that is 87% of all boilers in the industrial parks, have completed or are undergoing improvement. With respect to boiler fuel improvement, the analysis shows that most industrial boilers had switched to gas fuels (natural gas or liquefied petroleum gas) with diesel coming in at second place. As for commercial boilers, due to their smaller scales, most of them switched to electricity with some switching to gas fuel. The EPA and the MOEA will keep promoting boiler improvement to reduce air pollutants generated from fuel burning as they continue to strive to lessen the environmental loads brought by economic development.

Waste

Taiwan and the US Organized International E-Waste Management Network Workshop

The Taiwan EPA and the USPEA have been working together to promote the International Environmental Partnership. With the support of the Ministry of Foreign Affairs, the 9th International E-Waste Management Network Workshop was held in Bangkok, Thailand on 2-4 December 2019. Over 50 experts from nine partner countries took part in the meeting and, based on the sustainable development goals, shared about the partnerships each country has built for e-waste management and experiences on developing recycling management systems and innovative technology. The event greatly helped promote the exchange of international e-waste management information.

The Taiwan EPA noted that this year more experts and scholars were invited to join the delegation, which was led by Hsu-Ming Yan, Executive Secretary of the Recycling Fund Management Board. Besides experts and scholars from the field of environmental protection, recycling and treatment enterprisers were also among the delegates. Yan said the 9th International E-Waste Management Network Workshop, jointly held by the

two EPAs, greatly benefitted Taiwan in expanding bilateral and regional environmental collaboration as well as strengthening Asia-Pacific regional partnerships. The meeting also offered Taiwan an opportunity to share its own experiences in e-waste management to help solve e-waste problems.

The EPA further stated that Taiwan's successful recycling policies have become an example for other countries to build similar systems. The event allowed countries to exchange the developments of their e-waste recycling and management systems. Among the participating countries, Brazil shared its plans and challenges in the upcoming e-waste reverse logistics system. Such an experience can motivate partnering countries to start establishing their own



▶ Hsu-Ming Yan, Executive Secretary of the Recycling Fund Management Board of Taiwan EPA, gave a speech at the meeting.



▶ The 9th International E-Waste Management Network Workshop was held in Bangkok, Thailand

resource recycling systems. This is just one of many important results that came out of this global event that has been organized by Taiwan and the US over the years.

During this year's meeting in Bangkok, Taiwan continued to promote its successful recycling experiences and shared many innovative treatment

technologies that contribute to sustainable development and showcase Taiwan's industrial facilities and technological potentials. After three informative days of seminars and discussions, all participating countries learned much from one another and determined to continue working toward the vision of building environment-friendly recycling systems back home.

Soil & Groundwater

National Scholars Gather at Sediment Management Workshop

To strengthen overall environmental management capacity, the EPA held the Sediment Quality Assessment and Training Workshop on 3 December 2019. The workshop featured scholars and experts from several related fields, such as environmental engineering, public health and law. Its objective was to train local sediment pollution control personnel and improve their skills for faster sediment quality assessment, accurate management and water body sediment pollution prevention.



▲ EPA Deputy Minister Hung-Teh Tsai: the EPA has been promoting sediment control in Taiwan since sediment quality management was first included in the *Soil and Groundwater Pollution Remediation Act* in 2010

According to EPA Deputy Minister Hung-Teh Tsai, the EPA has been promoting sediment control in Taiwan since sediment quality management was first included in the *Soil and Groundwater Pollution Remediation Act* in 2010. Henceforth, the EPA has finished formulating the complementary regulations and implementation guidelines. In addition, with the diligent assistance of industry competent authorities, test reports regarding sediment quality in regulated

water bodies within the prior five years have all been submitted, representing a 100% completion rate. In the future, the EPA will continue to expand and update the national sediment management database, strengthen pollution control technology research and development, and organize more training workshops.

Sediment management looks at several factors

including pollution source and transportation, involving professional expertise from a wide range of fields. Since water bodies such as rivers, lakes, reservoirs, irrigation channels, ports and so on vary in shapes and types, strategies for sediment dredging and management should also vary accordingly. Also, since sediment pollution is closely related to people's daily lives, public participation needs to be further promoted so that environmental quality management can better suit citizens' needs. The EPA looks forward

to Taiwan's technological advancement in sediment management and ecological risk assessment. In the meantime, the EPA will work on establishing relevant management systems to improve environmental quality management in Taiwan, and collaborate with all sectors to keep up with international trends and expand technological expertise so as to meet local policy-making needs.

Air

Simplified Test Procedures for Diesel Vehicle Emission Opacity Preannounced

All diesel vehicles sold in Taiwan are either imported or authorized to be assembled within the country by the manufacturer. Hence, the smoke opacity test methods used in Taiwan, which apply to both new and in-use vehicles, were adopted from the snap-acceleration smoke test procedure widely used in most advanced countries.

To improve national air quality and protect public health, on 15 November 2019 the EPA preannounced the amendments to the *Opacity Test Methods and Procedures for Black Smoke in Diesel Vehicle Exhaust* (柴油汽車黑煙排放不透光率檢測方法及程序). The main points of the amendments are as follows:

1. The test procedure for vehicles with relatively low emissions has been simplified. The original test

procedure required the average value of three opacity tests to pass the standard, while with the revised procedure, vehicles passing the first test are exempt from further testing. The exemption is expected to reduce the test duration by 25% and consequently encourage car owners to perform regular car maintenance and repair. In addition, for simplicity and convenience, the EPA is also terminating the use of filter paper reflectometers in opacity tests.



The test procedure for diesel vehicles with relatively low emissions has been simplified

2. To prevent illegal vehicle modification and encourage proper vehicle maintenance, vehicles that have passed inspections performed by manufacturer-approved facilities and that have had recommended repairs completed (with maintenance records attached) are exempt from horsepower evaluation tests.

3. To ensure inspection quality, Article 35 of the *Air Pollution Control Act Enforcement Rules* stipulates that only personnel who have completed training and possess certified qualifications shall perform emission

inspections using instruments. To achieve uniformity of regulation, the preannounced amendments also include stipulations requiring personnel who conduct smoke opacity tests to receive training and certification from the central competent authority.

Diesel emissions that exceed regulated limits seriously impact air quality and public health. The EPA urges car owners to perform regular maintenance and repairs to help protect the environment and prevent getting fined.

Environmental Education

GEEP Regional Center Launched by Taiwan and US

Co-established by the Taiwan EPA and the USEPA, the Global Environmental Education Partnership (GEEP) Asia-Pacific Regional Center was launched on 3 December 2019 after two years of planning. In his opening remarks, EPA Minister Tzi-Chin Chang said the proposal of building an environmental education network for the Asia-Pacific area was first discussed in the 2017 GEEP meeting in Osaka, Japan. The establishment of the regional center fully demonstrates Taiwan's achievement and commitment in environmental education and makes Taiwan an environmental education center in the Asia-Pacific region.

The Global Environmental Education Partnership (GEEP) was founded by the Taiwan EPA and the USEPA to promote regional and global environmental education, and holds an annual conference with representatives from around the world. Now that the regional center is officially in operation, it will provide experts from different governments, industries, academia and non-governmental organizations an opportunity to cooperate and exchange knowledge. Through the center, Taiwan will also be able to share its own experiences with countries in the Asia-Pacific region and from around the world.

The regional center is located on the campus of National Taichung University of Education. Participants of the opening ceremony included: EPA Minister Tzi-Chin Chang; Director of the American Institute in Taiwan, William Brent Christensen; Director of the Office of International and Tribal Affairs of the USEPA, Mark Kasman; Executive Director of the North American Association for Environmental Education (NAAEE), Judy Braus; President of National Taichung University of Education, Ru-Jer Wang; Deputy Director-General of Taichung City Environmental Protection Bureau, Jeng-Liang Chen;

Representative of the Papua New Guinea Trade Office in Taiwan, Tommy Kambu Kunji; Director of the Manila Economic and Cultural Office, Arthur Abiera, Jr.; and Assistant Director General of the Ministry of Foreign Affairs, Yi-Long Wang.

The Taiwan EPA, USEPA, Taichung City Government, and NAAEE will operate the regional center and take joint responsibility to assist Asia-Pacific countries with developing environmental policies and implementation strategies at both local and national levels through providing training courses, technological support, guidance, and information exchange.



▲ Co-established by the Taiwan EPA and the USEPA, the GEEP Asia-Pacific Regional Center was launched on 3 December 2019

Environmental Education

Schools Honored at 2019 Eco-Campus Award Ceremony

The US-Taiwan Eco-Campus Partnership Program 2019 Award Ceremony was held on 4 December at Jinlong Elementary School in Xizhi District, New Taipei City. The EPA hosted Mark Kasman, Director of the Office of International and Tribal Affairs from the U.S. Environmental Protection Agency (USEPA), and guests from the American Institute in Taiwan. Representatives from the Ministry of Education, local environmental and educational agencies, and eco-campuses were also in attendance. Schools were awarded certifications during the ceremony, including green flags for three schools, silver medals for 13, and bronze medals for 21.

As part of the exhibition at the ceremony, schools created posters to display their achievements in environmental protection. The three schools that received green flags, which were only awarded to schools with top performance, included: Xintai Elementary School in Xinzhuang District, New Taipei City; Sheziguomin Elementary School in Xinwu District, Taoyuan City; and Chaocuo Waldorf Education Experimental Elementary School in Yunlin County. Among these schools, Chaocuo Waldorf Education Experimental Elementary School became the third school in Taiwan to receive the green flag certification twice. There is now a total of 11 green-flag certified schools in Taiwan, which is a vivid demonstration of Taiwan's accomplishment in environmental education.

At the opening ceremony, joint host – and eventual silver medal recipient – Jinlong Elementary School had students from its Latin dancing club deliver an outstanding performance that fascinated the entire audience. After the ceremony, guests were further amazed by a tour of the school showcasing the results of their environmental projects, such as a rooftop garden that utilized food waste for fertilizer and an educational insectarium built in an empty classroom.

As part of the International Environmental Partnership (IEP), the objective of the US-Taiwan Eco-Campus Partnership Program is to promote eco-campuses and strengthen cooperation in the field of environmental education between Taiwan and the

United States. Eco-campuses increase environmental knowledge and foster concern, observational skills and behavioral change among students. The experience of promoting environmental sustainability in schools is expected to spread further into communities to help realize the goal of building a sustainable homeland. Through international exchanges and cooperation, environmental education in Taiwan will hopefully take root and keep up with international trends.

Supported by the Ministry of Foreign Affairs, the IEP was launched in 2014 by the EPA and its founding partner, the USEPA. The IEP has connected experts from all over the world and established a diverse platform where they exchange professional insights on common environmental challenges and on capacity building of schools, communities and nations. Through the IEP, different countries can strive together at the regional or international level to make the world a better place.

Monitoring

Internet of Things Sensors to Tackle Air, Water and Noise Pollution

The EPA has developed new smart law enforcement devices for different types of pollution, including: unmanned aerial vehicles (UAVs) equipped with air quality sensors for 3D sensing, trackable mobile air quality sensors for flexible monitoring, underwater water quality sensors with a concealment function, and noise detection and tracking devices with microphone arrays. In addition to the new technologies, the EPA continued to work with local environmental agencies to install air quality sensors and presented the monitoring results during 2019 IT Month.

There have been several significant breakthroughs in the application of environmental monitoring sensors in 2019. The following is a list of new devices Taiwan is currently deploying:

1. To better understand the dispersion of air pollutants and their impacts on ground-level air quality, the EPA worked with the Central Weather Bureau and developed UAVs equipped with high-altitude air pollutant sensors.
2. Air quality sensors mounted on vehicles that can show mobile source pollution changes with time and space.
3. Fixed and portable water quality sensors to track down the hot zones of factory wastewater contamination.
4. Cameras that can identify license plates combined with microphone array-based sensors to detect noise sources.

With the assistance of local environmental bureaus, the EPA has installed 6,000 air quality sensors in Taiwan, spanning 147 cities/towns, 55 major

industrial parks, 169 main roads, 192 communities, and more than 30,000 factories. The sensors have been especially a big help in detecting environmental violations committed by factories. By the end of October 2019, the EPA had issued fines totaling NT\$86,460,000 and collected more than NT\$400,000,000 in air pollution fees.

As part of 2019 IT Month, the EPA held an exhibition focusing on the Internet of Things (IoT) for environmental sustainability. The month-long exhibition kicked off on 4 December and would travel around Taiwan. It features interactive activities to demonstrate that information technology can be utilized to help solve problems that were deemed difficult to solve in the past and how the era of using IoT technology for smart and continuous monitoring has arrived.

Noise Control

Innovative Noise-Canceling Windows Block Noise While Allowing Ventilation

Noise control has always been a hot topic in Taiwan. The EPA has not only been strengthening control of noise pollution sources through government regulations, but also continues to develop new control technologies. After considering innovative concepts of active noise control technology that have been used in other countries, the EPA recently installed the first set of noise-cancelling windows for demonstration in Taiwan. Initial studies have shown that these windows can reduce noise by about 3 decibels while still allowing for proper indoor ventilation.

Active Noise Control (ANC) is a method that reduces noise by using a computer to analyze the perceived noise sources and generating an inverted wave to cancel the noise out. The market has already been filled with products utilizing ANC technology, including active noise-canceling earphones, and noise-canceling systems in confined spaces such as cars and airplanes.

Installing noise-canceling windows for noise control in public places came as an outcome of initial studies and new concepts from the EPA's technology program during 2019. Since noise-canceling windows are not yet commercialized and are still at the early stage of development both in Taiwan and overseas, the EPA will continue to do research on the practical applications of ANC systems and related details such as suitable space sizes.



▲ Installing noise-canceling windows for noise control in public places

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