

Sharing Experience of APEC Oil and Gas Security Exercises with Chinese Taipei

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ABSTRACT

This paper discusses the results of APEC's Oil and Gas Security Exercises (OGSE). OGSE aims to strengthen capacities and systems for oil and gas emergency response in the APEC economies. As of August 2019, APERC has held OGSE in Thailand, Indonesia, the Philippines, Australia, Peru and Chile. Some exercises are held only for host economy, while some are joint exercises that involved more than one economies. Chinese Taipei may have already established a relatively solid system for oil and gas emergency response. However, Chinese Taipei will still be benefitted from hosting OGSE by receiving advice from international experts who are otherwise difficult to invite.

Keywords: energy security, security exercise, oil and gas emergency, emergency response.

1. Introduction: APEC and APERC

In 1989, the Asia Pacific Economic Cooperation (APEC) was established as a framework for economic cooperation among countries and territories (who are called 'economies' in APEC) in the Asia and Pacific Region. APEC currently consists of 21 member economies: Australia, Brunei Darussalam, Canada, Chile, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, the Philippines, Russia, Singapore, Chinese Taipei, Thailand, the United States and Viet Nam [APEC EWG, 2019a]. As shown above, Taiwan is called 'Chinese Taipei' in APEC. Chinese Taipei joined APEC in 1991 together

with People's Republic of China, and Hong Kong, China¹.

Energy cooperation has been an important agenda item for APEC. Apart from APEC Economic Leaders' Meeting (AELM) and APEC Ministerial Meeting (AMM) of foreign and trade ministers, there are APEC Sectoral Ministerial Meetings, among which Energy Ministers Meeting (EMM) has been active. Under the guidance of EMM, senior energy officials of APEC member economies formed the Energy Working Group (EWG) in 1990 which is undoubtedly one of the most active working groups in APEC.

In order to support EMM and EWG, the Asia Pacific Energy Research Centre (APERC) was established in 1996 in Tokyo by the initiative of the Japanese Government. Since then, APERC

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¹ Hong Kong, China joined APEC under the name Hong Kong during British Administration in 1991. The name was changed to Hong Kong, China in 1997 when Hong Kong became a Special Administrative Region of the People's Republic of China.

has published APEC Energy Demand and Supply Outlook every three years and various research reports on energy issues including energy security. Since around 2010, APERC further expanded its activities to include policy cooperative projects such as Peer Review on Energy Efficiency (PREE) and Low-Carbon Model Town (LCMT) project.

2. Background: ESI, OGSE and OGS

According to EWG website, energy security comes first among EWG's four aims: "Strengthening regional and domestic energy security and resilience across the region" [APEC EWG, 2019a]. As such, enhancing domestic and regional energy security is a key component of APEC's energy agenda.

Toward this aim, the EWG established the Energy Security Initiative (ESI), which was endorsed by APEC Leaders in October 2001. The ESI comprises a series of measures to respond to temporary energy supply disruptions and longer-term challenges facing the region's energy supply. For APEC energy cooperation, EWG holds semi-annual meetings since its inception, and the agendas were designed according to the ESI. In that way, almost all agenda items, except for those of logistical matters, are related to energy security. For example, energy efficiency and renewable energy are both considered as measures to improve energy security.

However, as climate change issues became a serious global concern, APEC members gradually shifted their focus of energy policy from energy security to climate change. Policy measures for energy security such as improving energy efficiency or introducing renewable energies are evaluated more from the viewpoint of climate

change. In 2007, APEC Leaders agreed to a regional aspirational goal of reducing energy intensity by at least 25 percent by 2030 with a 2005 base year. APEC Leaders agreed in 2011 to substantially increase the goal to a 45 percent reduction of regional aggregate energy intensity by 2035. At the 2014 APEC Leaders' Meeting, Leaders endorsed a new aspirational goal to double the share of renewable energy in APEC's overall energy mix by 2030 over 2010 levels. These aspirational goals are regarded to achieve the global climate goals. The EWG web page clearly writes 'Reducing Energy Intensity' and 'Doubling Renewable Energy' as separated items from 'Enhancing Energy Security' in their major goals [APEC EWG, 2019b]. This shift in focus reflects waning concern over energy security since the latter half of the first decade of this century.

Having said that, energy security is still a precondition for maintaining economic and social development in the APEC Region. According to the 7th Edition of APEC Energy Demand and Supply Outlook (hereafter the Outlook), fossil energy is expected to be dominant in the APEC economies' energy supply mix. Oil will continue to be the most important energy resource [APERC, 2019a]. Thus, oil supply security deserves significant attention. Gas has also been a focus of supply security since its share in the energy portfolio has significantly increased in some APEC economies.

Recognizing the significance of energy security, Japan proposed to revitalize APEC cooperation for energy security by focusing on oil and gas security at the 10th APEC Energy Ministerial Meeting (EMM10) in St. Petersburg, Russia in June 2012. In consideration of the importance of improving responses to oil and gas supply disruptions, the Ministers gave a clear instruction to the EWG and APERC as follows:

We encourage the EWG and APERC to work in collaboration with the International Energy Agency (IEA) and the Association of Southeast Asian Nations (ASEAN) on activities to improve the response to oil and gas emergency situations in the APEC region, including emergency response workshops and exercises [2012 APEC Energy Ministerial Meeting Statements, 2012].

In response to this instruction, APERC conducted the first two oil and gas security exercises (OGSE) in 2013.

At the 11th APEC Energy Ministerial Meeting (EMM11) in Beijing, China, in September 2014, the APEC Energy Ministers gave further instructions to strengthen capacities and systems for oil and gas emergency response in the APEC economies, as stated below:

We encourage APEC member economies to improve capacity building in oil and gas emergency response, including strengthening their own systems such as oil and gas stockpiles and supply chains that suit their own circumstances. We instruct the EWG, including through APERC, to continue cooperation on emergency response, with the International Energy Agency (IEA), ASEAN, the Economic Research Institute for ASEAN and East Asia (ERIA) and other international organizations. We also encourage member economies to conduct oil and gas security exercises on a voluntary basis, establish an APEC oil and gas security framework and do research on oil and gas security, so as to improve the capacity of the APEC region to respond to emergencies such as disruptions in oil and gas supply [2014 APEC Energy Ministerial Meeting Statements, 2014].

Based on this instruction, APERC launched APEC

Oil and Gas Security Initiative (OGSI) project. Under the OGSI, APERC has continued the OGSE. So far, the Philippines, Australia, Peru and Chile hosted the exercise.

3. Precedents of Oil and Gas Security Exercises

3.1 The Joint Southeast Asian Exercise

The first OGSE, the Joint Southeast Asian Exercise, was held in 18-20 September 2013 in Bangkok, Thailand. Seven economies participated the exercise: Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Viet Nam. These economies are both members of APEC and ASEAN (Association of South-East Asian Nations). There were 32 government officials in charge of oil and/or gas supply security participating in the exercise. In addition, ten officers from Thailand's national oil and electricity companies joined the exercise.

APERC organized the expert review team in consultation with the participating economies. The team's responsibilities were to assess, comment and provide recommendations to the participants' responses on the presented emergency scenarios for oil and gas. There were 11 experts joined the exercise, four of them came from international or regional organizations: the International Energy Agency (IEA), ASEAN Council on Petroleum (ASCOPE), Heads of ASEAN Power Utilities/Authorities (HAPUA), and Economic Research Institute for ASEAN and East Asia (ERIA). Other seven experts came from governments, universities or research institutes of APEC member economies: Indonesia (university), Japan (government and research institute), Korea (research institute),

and Thailand (university). Five researchers from APERC supported the team.

APERC presented two stages of hypothetical emergency scenarios to the seven participating economies. The first stage assumed a common oil emergency situation, which a terrorist group sabotaged the shipment of oil and natural gas exports from the Middle East with both physical and cyber-attack. It consisted of three phases during which the imported oil and LNG (Liquefied Natural Gas) supplies from the Middle East would be reduced and their prices go up due to terrorist activities. The second stage dealt with incidents unique to each of the economy under the assumption that a natural disaster, such as typhoon, or another type of accident damaged gas facilities in each economy.

The experts gave comments and suggestions on the responses made by the participating economies, including identifying all related institutions of the economies that should be involved in an emergency and their key priorities, as well as enhancing capacity building as additional measures to be used during oil and gas emergency situation. The experts also recommended to include some statistics to clearly show how a particular emergency situation could affect the economies' supply and demand situation, and to consider additional measures as most of the indicated ones cannot be implemented immediately in an emergency [APERC, 2014].

This was the first OGSE and it involved many APEC economies with different energy situations. Expert recommendations were more general, which covered basic suggestions of institutional establishment and procedures, rather than specific to any stage or economy.

3.2 The Indonesia Exercise

In order to further elaborate responding measures of oil supply security for Indonesia, the second OGSE was held during 22-24 October 2013 in Jakarta, Indonesia, following up the first OGSE in the same year. In the exercise, a three-stage oil emergency scenario was presented to officials in charge of the stable supply of oil in the Indonesian Government. There were 25 government officials participated in the exercise, they were from not only Ministry of Energy and Mineral Resources but also other ministries/agencies such as Ministry of Transportation or Ministry of Finance. Energy companies sent 19 officers and one energy association sent two officers.

The expert review team attended the Indonesia Exercise was made up of ten experts: five experts from international and regional organizations [IEA, ASEAN Centre for Energy (ACE), ASCOPE, HAPUA, ERIA] and also five experts from APEC economies (Indonesia, Japan, Korea). The team was supported by six researchers from APERC.

The format of the OGSE in Indonesia was a 'blind' exercise, which participants were briefed about hypothetical supply disruptions without prior notice. In the first stage of the scenario, an earthquake damaged Indonesia's Cilacap Refinery leading to decreased petroleum production. Indonesia categorized this emergency at the company level, proposing the national oil company, PERTAMINA, to respond to the incident. Responses included a range of supplementary and/or alternative measures to secure energy supply. The expert team recommended the Indonesian government to fully support PERTAMINA's measures.

The second stage of the scenario envisaged the situation worsened in the refinery because of a major aftershock. The third stage of the scenario assumed local residents cut off the crude

oil pipeline from Bangko to Dumai Refinery, leading to a decrease of the refining capacity. The government categorized the incident at the national level and proposed both supply-side and demand-side measures. The experts recommended that Indonesia should prepare for the real emergency situations in certain areas [APERC, 2014].

In the first stage, the review experts recommended the Indonesian Government to fully support PERTAMINA's measures by securing not only financial means for importing the required fuels, but also through policy and regulatory measures. The experts also recommended the government and PERTAMINA to work together to prepare a public communication plan to avoid panic buying of fuels. For the national oil company, the experts recommended to consider including a special clause in its long-term oil-import contracts to enable it to decrease its oil imports in case of emergency, as well as to consider securing a proper spare capacity of its domestic refineries to uplift their fuel production in case of emergency [APERC, 2014].

In the second stage, the experts pointed out that, in order to carry out crude processing deals, the Indonesian government must obtain information about the suitable available refineries abroad, conclude refining-assignment contracts with their respective economies, and secure the required financial means. The government should also be ready to repair damaged refineries as soon as possible and prepare a priority list for oil-rationing [APERC, 2014].

For the third stage, the experts suggested the government devise measures that can be easily implemented in emergencies to reduce fuel consumption, including energy export restrictions, car-pooling, work time shift and working at home (telecommuting) [APERC, 2014].

This was the first exercise that designed for one single economy with blind exercise. The hypothetical scenarios developed in three stages constructed a very strict oil demand and supply situation in Indonesia. The experts' recommendations were more specific and concrete. Unlike the joint Southeast Asian exercise, the scenarios consisted of natural and man-made disasters without geopolitical risks. Such events could occur in anytime and anywhere, which made the scenarios more realistic.

3.3 The Philippines Exercise

The third OGSE was held in the Philippines during 7-9 December 2015 in Bataan Province, right after the exercise incorporated into OGSI project. 28 Filipino officials participated in this exercise from various government agencies that relate to oil and gas supply security in the Philippines, including Coast Guard and National Police. In addition, 8 officers from energy companies/associations in the Philippines joined the exercise.

The expert review team consisted of ten experts. Five experts were from international and regional organizations (IEA, ACE, ASCOPE, HAPUA, ERIA) and another five experts from APEC economies (Japan, Korea, the United States, the Philippines). The team was supported by seven researchers from APERC and the Institute of Energy Economics, Japan (IEEJ).

In this exercise, several threats to energy security were assumed in three stages of an emergency scenario [APERC, 2016]. The first stage was gas emergency scenario. The collision of a cargo ship and an oil tanker caused the cargo ship to sink and damaged the Malampaya underwater gas pipeline, resulting in loss of natural gas supply to fuel three power plants. To address

the gas supply emergency situation, the Philippines proposed to secure power supply through using fuels such as condensate and diesel. Two of the natural gas power plants can run with condensate and the other can run with diesel but with lower capacity. Rescheduling of maintenance of other power plants will be also strictly enforced, and to utilize all standby oil-based power plants. On the demand side, the Interruptible Load Program will be implemented to reduce electricity demand during peak hours, as well as other demand side management [APEREC, 2016].

The second stage was oil emergency scenario. A strong typhoon caused damage to the Petron Refinery in Bataan Province, which worsened the situation as the alternate fuel for the other natural gas power plant is diesel and that standby oil-based power plants will be tapped under the first scenario. The shutdown of Petron resulted in loss of oil supply for the economy. In addressing the second emergency situation, the Philippines proposed to request oil companies to increase oil imports from existing and potential sources. Lifting of mandatory 15-day inventory will be imposed to utilize all available oil stocks. To restrain demand, energy conservation measures like reduce operating hours of gas stations, shopping malls and other entertainment establishment will be undertaken. As last recourse, fuel rationing may be done in accordance to sectoral requirement and priority. The expert team suggested that the government should prioritize securing additional supply as demand restraint has economic and social implications [APEREC, 2016].

The third stage was another oil emergency scenario. The strong typhoon that hit the Philippines in the second stage continued to move north and hit Chinese Taipei, which is one of the major exporters of petroleum products for

the Philippines. The typhoon made a landfall in Chinese Taipei and caused damage to two oil refinery facilities, which resulted in a reduction of their oil product exports to the Philippines. With this, Chinese Taipei decided to reduce its export by 30%. The decision resulted in 9% reduction in total petroleum products imports bringing the oil supply shortage to 39%. As a response to the third scenario, the Philippines planned to intensify all measures identified in the second scenario. However, for this scenario, the government will invoke the ASEAN Petroleum Security Agreement (APSA), an emergency supply sharing scheme under the ASEAN energy cooperation [APEREC, 2016].

The first stage of the exercise was a gas emergency situation. The experts recommended the Philippines government to establish a well-organized structure to improve the reporting process during supply disruption to ensure accurate information is given to high officials or decision makers for the formulation and implementation of emergency policies and measures. The team also recommended the government to consider a functional reserve market to provide immediate source of additional power supply, as the Malampaya shutdown would affect electricity generation. Redundancy system in the Malampaya facility was also recommended to avoid total shutdown. As an option, the team suggested LNG infrastructure must also be put in place to receive imports [APEREC, 2016].

The second stage was an oil emergency situation. The expert team recommended the government to prioritize securing additional supply as demand restraint had economic and social implications. The team also recommended to estimate the impact of oil supply shortfall to the different economic sectors and to the public

to have better information for the government to institute a mechanism to avoid panic and calm down the public. The government was requested to have alternative plans on how to address the emergency situations to include mapping out the potential import sources. The government was also requested to formulate a legal framework mandating oil companies to support Petron [APERC, 2016].

In the third stage, the oil emergency situation further worsened. The expert team recommended formulation of a nationwide communication campaign calling to save fuel and energy, establishment of a cooperation framework with other economies having huge emergency stocks and creation of a special lane or specific institution to streamline the process and procedure for securing import permit [APERC, 2016].

It is noteworthy that the Philippines exercise started with a gas emergency situation which is widely regarded more troublesome mainly due to the difficulty of gas stockpiling. On top of the gas emergency, oil supply shortage was assumed and further worsened. These escalation scenarios were tight energy situations to the Philippines participants, some commented that the scenarios were too severe and unrealistic. However, this is one of the merits of conducting an OGSE, prepare yourself in a severe and harsh energy supply disruptions.

3.4 The Australia Exercise for Regional Capacity Building

The fourth OGSE was held in Melbourne, Australia on 29-31 March 2017. The exercise was a regional capacity building with participation from other APEC economies: Indonesia, the Philippines and Thailand. There were six government officials (five from Department of the

Environment and Energy and one from Department of Foreign Affairs and Trade) and three consultants from Australia. Indonesia sent three government officials, while the Philippines and Thailand sent two officials each.

Seven invited experts formed the expert review team. Three experts came from international and regional organizations: IEA, ACE, ERIA. Other four experts were from APEC economies: Australia (government), Japan (government and a research institute), the United States (government). The team was supported by four researchers from APERC.

The first day was devoted for capacity building workshop providing an overview of the global oil and natural gas markets, supply resilience in the APEC region, and Australian energy policy and emergency response framework.

The second day was the emergency exercise with hypothetical supply disruption scenarios for both oil and natural gas. A global oil supply disruption scenario was formulated, while a separate gas scenario was produced for each participating economies taking into account their individual domestic gas situations. Like the first OGSE in Bangkok, APERC presented the scenarios to the participating economies before the exercise because of the time constraints of the exercise agenda arrangement.

In the oil supply disruption scenario, the Strait of Hormuz was closed due to a collision of oil tankers, which prevented Middle Eastern crude oil, specifically from Saudi Arabia, the United Arab Emirates, Kuwait, Qatar, Iran and Iraq, from being transported. Each economy prepared and explained their plan to respond to the oil supply emergency. From these responses, the expert review team made a list of observations, comments and recommendations. Broadly, the team emphasized

that relying on diversity of supply, although helpful, does not wholly mitigate the disruption from a global perspective. Only adding additional supplies or reducing demand will make a global impact [APERC, 2017].

As for gas emergency scenarios, in the case of Indonesia, a series of computer virus attack paralyzed some of the major gas platforms. For the Philippines, a fire broke out in the control room of Malampaya gas platform, the major source of natural gas in the economy. Thailand's emergency scenario covered two incidents – no LNG imports from Qatar due to the closing of Strait of Hormuz, and the mechanical failure occurred in the connecting point linking the offshore pipeline from Myanmar and the onshore pipeline going to Thailand. Each economy also prepared and explained their plan to respond the gas supply emergency. From these responses, the expert review team suggested that Indonesia considers developing alternatives to reliance on gas, in particular in the production of fertilizer for food security. For the Philippines, the Team opined that though the 15-day supply of alternate fuels is a good strategy, the government should assess if such stockholding makes economic sense. On Thailand's supply-side measures, the Team commented that sending gas from east to west via the east-west pipeline is not an appropriate emergency strategy considering the different qualities of gas [APERC, 2017].

Although Australia participated in the oil and gas security exercise, its emergency scenario and response measures were not included in the final report of the OGSE because of their confidentiality policy. Thus, they cannot be introduced here [APERC, 2017].

This exercise was a “non-blind” exercise because there were four participating economies

and the discussion time was limited. Nevertheless, after the accumulation of experience and knowledge of the experts and delegates, the exercise results for Indonesia, the Philippines and Thailand were more fruitful.

3.5 The Peru Exercise

Peru hosted of the fifth OGSE, which took place in Lima on 6-8 November 2017. It was the first OGSE in the Americas. The event gathered 25 Peruvian participants representing the relevant stakeholders in the oil and gas industry, including officials from Peru's central and local governments, and representatives from Peruvian energy companies.

APERC invited six oil and gas security experts from the APEC region to form the OGSE expert review team. Three experts came from regional organizations: the Latin American Energy Organization (OLADE), the Inter-American Development Bank (IADB), and ERIA. Due to conflicting schedules, IEA could not send its expert to OGSE for the first time. Other three experts were from APEC economies: Japan (semi-governmental organization), Peru (academia) and the United States (government).

As for format of the exercise, the OGSE in Peru returned to a ‘blind’ type exercise. On the first day, an oil and oil products supply disruption scenario was presented. Peru's largest refinery, La Pampilla, was severely damaged by an 8.8 magnitude earthquake. A total and abrupt shutdown of the refinery was assumed, with a total loss of production of fuel products and around 50% of stock products. The participants' response included importing extraordinary oil products cargoes, bringing fuel products from the Talara refinery for limited time, clearing major highways and roads to transport oil products from other refineries or

terminals, rationing demand and canceling non-essential activities [APEREC, 2018].

Based on the responses of the participants, the expert review team provided a series of recommendations for a possible disruption on oil supply. For example, working closely with refinery owners to find ways of supplying lost production; coordinating with traders to import additional gasoline and diesel through existing channels; teaming up with PetroPeru to run more crude oil at their refineries; releasing the obligatory 15-day inventory; determining the feasibility of liquid fuel rationing; setting up an organization responsible for monitoring and holding oil products emergency stocks; establishing a joint oil stockpiling company with the private sector; actively promoting joint stockpile measures among companies to increase stock capacity in the private sector; enhancing ethanol production and planning energy rationing programs for each refinery [APEREC, 2018].

On the second day, a separate disruption scenario was presented for gas supply, which is independent from the oil disruption scenario. A landslide was assumed to fracture the Camisea gas pipeline, which transports more than 95% of Peru's natural gas production, stopping all gas flows. Without gas, about 60% of total power generation capacity would be out of service. The participants' responses included assuring there were no other fractures or leaks in the pipeline, maximizing hydropower generation, dispatching as much as possible power plants fueled by oil and coal, importing as much electricity as possible from Ecuador, rationalizing power demand with the exception of vital facilities, suspending all LNG export cargoes, using gas available in the LNG exports plant facility and maximizing the use of LPG as a substitute fuel [APEREC, 2018].

The experts gave several recommendations

on gas scenario responses. For example, diversifying power generation sources to reduce gas dependency, especially by promoting renewable sources; conducting a thorough analysis for building a floating storage and regasification unit (FSRU) to import gas; reactivating the construction of the Gasoducto Sur Peruano gas pipeline; considering infrastructure planning and investment strategies to improve flexibility on gas supply in pre- and post-disruption scenarios; finding a long-term agreement to use Peru LNG's liquefaction plant storage capacity in emergency cases; reviewing regulations and incentives to attract capital and technology from investors willing to bet on Peru's hydrocarbon exploration, production and general industry development; determining the feasibility of electricity rationing in a prioritized and ordered way as a last resource measure [APEREC, 2018].

Considering the participants' comments at the Philippines exercise, the Peru exercise did not introduce escalating scenarios for the first time. An oil emergency and a gas emergency were not assumed to occur successively. As such case is more realistic, the Peru exercise scenarios were more well received the Peruvian participants. Although this realistic scenarios may robbed the participants a chance to be trained in extremely hard cases, the realistic scenarios seemed to encourage the Peruvian participants to actively join the discussion.

3.6 The Chile Exercise

The sixth Oil and Gas Security Exercise was held in Santiago, Chile on March 13-15, 2019. The final report is now under compilation and will be made public in the second half of 2019. Before that, the contents of the exercise are kept confidential according to the rule of APEC OGSE.

3.7 Observations on Previous Exercises

In the previous five exercises (the sixth Chile exercise report is not published yet so cannot be discussed here), major issues for oil or gas emergency responses were all covered. Of course, the priority and the focus were different in each economy, the cross-cutting issues such as institutional settings, public awareness, additional supply, demand management and cooperation with outside were discussed. With accumulation of experience and knowledge, review experts can produce more concrete and specific recommendations, making final reports of exercises useful for the hosting economy (see table 1).

The hypothetical scenarios for exercises became more realistic for participants. Severe cases were sometimes good for exercises, but if the scenarios were unrealistic, participants may be discouraged to respond the emergency situations.

The seventh exercise will be held in Thailand in 2020. As Thailand has already participated in the first joint Southeast Asian exercise and the fourth Australia exercise, the Thailand exercise is expected to produce more refined responses and recommendations which can benefit other APEC economies.

4. Expectations to Chinese Taipei

4.1 Merits of OGSE in Chinese Taipei

The imported oil, coal and natural gas dominate Chinese Taipei's total primary energy supply (TPES). Oil had the largest share of TPES

(48%) in 2018, and natural gas (15%) came third. In total, oil and natural gas supplied more than half of TPES in Chinese Taipei [BOE, MOEA, 2018a].

The Outlook projects that the nuclear share declines to zero as Chinese Taipei retires its three nuclear power plants in 2025 under the Business-as Usual (BAU)² scenario. To fill the supply gap, shares of other fuels increase, especially natural gas, which grows to 18%. Coal and oil shares remain largely the same. That means supply security of oil and natural gas will be more important for Chinese Taipei in the coming years [APEREC, 2019b].

According to *APEC Energy Overview 2018*, as Chinese Taipei heavily relies on energy imports, the government has put in multiple measures to enhance energy security. For oil supply security, the Petroleum Administration Act requires refiners and importers to maintain 60 days of sales volumes as stockpiles. The government uses the petroleum fund to finance the storage of oil and also stockpiles 30 days of oil consumption. The Act mandates that a liquid petroleum gas stockpile lasting more than 25 days be maintained. A state-owned oil and gas company, the Chinese Petroleum Corporation (CPC) has boosted domestic energy production and also engaged in exploration throughout the Americas, the Asia-Pacific region and Africa [APEREC, 2019c]. The overall oil stockpiling in private sector and the government would reach roughly the same level to the stockpiling obligation (at least 90 days of oil import) of IEA member countries.

For gas supply security, the Natural Gas Business Act was amended in 2018 and requires producer and importers to maintain certain days of sales volume as stockpiles. Gas producers are

²The BAU Scenario reflects existing policies and extends current trends.

Table 1. Summary of APEC Oil and Gas Security Exercises (OGSE) (by author)

Name	Date & Venue	Economies	Format	Scenarios	Major Recommendations
Joint Southeast Asian exercise	2013/9/18-20 Bangkok, Thailand	Brunei, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Viet Nam	Non-blind*	Oil: A terrorist group's sabotage [<i>Geopolitical risk</i>] ↓ Gas: Typhoon or accidents [<i>Natural Disaster Accident</i>]	- Involvement of all related institutions in the economies - Capacity building - Statistics - Additional immediate measures
Indonesia exercise	2013/10/22-24 Jakarta, Indonesia	Indonesia	Blind	Oil 1: An earthquake. [<i>Natural Disaster</i>] ↓ Oil 2: A major aftershock [<i>Natural Disaster</i>] ↓ Oil 3: Local residents behaviour [<i>Man-made Disaster</i>]	Oil 1: - Government's support to the oil company - Public communication plan - Special clause in long-term oil-import contracts - Spare refining capacity Oil 2: - Information for crude processing deals - Repair of damaged refineries - Priority list for oil-rationing. Oil 3: - Regulations for energy export restrictions and car-pooling. - Work time shift, including work at home
The Philippines exercise	2015/12/7-9 Bataan Province, the Philippines	The Philippines	Blind	Gas: The collision of ships [<i>Accident</i>] ↓ Oil 1: A strong typhoon [<i>Natural Disaster</i>] ↓ Oil 2: The strong typhoon to Chinese Taipei [<i>Natural Disaster</i>]	Gas: - Reporting process - Functional reserve market - Redundancy in the gas facility Oil 1: - Additional supply - Estimation of the impact of oil supply shortfall - Alternative plans to address the emergency situation - Legal framework for mandating oil companies to support the damaged company Oil 2: - Nationwide communication campaign - Cooperation framework with other economies - Streamlining of the process/procedure for securing import permit
Australia exercise for regional capacity building	2017/3/29-31 Melbourne, Australia	Australia, Indonesia, the Philippines and Thailand	Non-blind	Oil: A collision of oil tankers at the Strait of Hormuz [<i>Accident</i>] ↓ Gas (Indonesia): Computer virus attacks [<i>Cyber Attack</i>] Gas (The Philippines): A fire [<i>Accident</i>] Gas (Thailand): The mechanical failure [<i>Accident</i>]	Oil: - Additional supplies or reducing demand against a global impact Gas (Indonesia): - Alternatives to reliance on gas Gas (The Philippines): - Economic sense of the 15-day supply of alternate fuels Gas (Thailand): - Not sending gas from east to west via the east-west pipeline
Peru exercise	2017/11/6-8 Lima, Peru	Peru	Blind	Oil: An earthquake [<i>Natural Disaster</i>]	Oil: - Cooperation with refinery owners - Co-ordination with traders - Teaming up with PetroPeru - Release the obligatory inventory. - Liquid fuel rationing - Organisation responsible for monitoring and holding oil products emergency stocks - Joint oil stockpiling company - Joint stockpile measures. - Ethanol production - Energy rationing programs for each refinery.
				Gas: A landslide [<i>Natural Disaster</i>]	Gas: - Diversification of power generation sources - Floating Storage and Regasification Unit (FSRU) to import gas. - Construction of the Gasoducto Sur Peruano gas pipeline. - Infrastructure planning and investment strategies to improve flexibility on gas supply - long-term agreement to use Peru LNG's liquefaction plant storage capacity - Review regulations and incentives on Peru's hydrocarbon sector - Electricity rationing
Chile exercise	2019/3/13-15 Santiago, Chile	Chile	Blind	NA**	NA**

* "Non-blind" means participants were briefed about scenarios with prior notice, while "Blind" means they were briefed without notice.

** Not available before the publication of the final report of the exercise.

required to maintain half a day volume, while gas importers are required to have seven days of sales volumes as stockpiles from 2019. Required stockpiles for importers will increase gradually up to 14 days in 2027. As natural gas is technically difficult to store, mandatory stockpiling system is rare in the world even though the number of required days of stockpiling is close to running stock for suppliers [BOE, MOEA, 2018b].

In addition, Chinese Taipei may have already introduced effective measures for oil and gas emergency response, including protocols for using fuel stockpiles in supply side and fuel rationing in demand side. With the well-constructed framework, Chinese Taipei can carry out emergency exercises by themselves without doubts.

Some of developed countries have already build up stronger system for oil and gas emergency than Chinese Taipei. For example, the US and Japan keep much larger volume of oil stockpile than IEA's 90 days requirement. Also, they can rely on cooperation among IEA members such as oil sharing through the International Energy program (IEP). On the other hand, many economies in the Asia Pacific region do not have mandatory oil stockpiling. It is still fair to say that Chinese Taipei may have already established a relatively solid system for oil and gas emergency response with substantial amount of fuel stockpiling and necessary procedures to use such stockpiling.

However, Chinese Taipei can still be benefitted from hosting OGSE. With the presence of outside experts, the exercise can bring tensions to government officials and other stakeholders through real-time scenario simulation. Moreover, Chinese Taipei can receive valuable advice from international and regional experts. Using the framework of APEC, experts can be invited from international organizations such as IEA and

APEC economies including Japan and the United States. Those invitation will be very troublesome if it were made bilaterally. Suggestions and recommendations by experts would be beneficial for Chinese Taipei to improve its emergency preparedness. Needless to say, the nomination of experts will be decided by consensus between Chinese Taipei and APERC.

Since OGSE deals energy security issues which are parts of national security, there might be concern of information confidentiality for Chinese Taipei. As explained for precedents of OGSE, the contents of exercise will be kept confidential before the release of the final report which should be reviewed and endorsed by the host economy. Any information which Chinese Taipei does not want to make public can be excluded from the final report.

4.2 A Possible Format of OGSE in Chinese Taipei

A possible format of OGSE in Chinese Taipei would be similar to the previous exercise that only involves one host economy, such as the Indonesia OGSE, the Philippines OGSE and the Peru OGSE.

The Chinese Taipei government has to convene officials in charge of oil and gas supply security, who are mainly from the Bureau of Energy, Ministry of Economic Affairs. However, officials from other ministries/agencies are also welcome as oil and gas are widely used in various sectors including transport, industry and buildings. Their supply security may involve other departments' jurisdiction. Participants from business sector are also required. At least officers from CPC (Chinese Petroleum Corporation, Taiwan) and Taiwan Power Company (Taipower) need to participate.

As mentioned above, review experts will

be nominated by consensus between Chinese Taipei and APERC. Judging from precedents, international/regional experts are mostly from IEA and ERIA. Three or four experts would be invited from APEC economies: Japan (government or semi-governmental organization, and/or research institute), Chinese Taipei (academia) and the United States (government). An academic from Chinese Taipei would be ideal as to ensure the exercise scenario design reflects the reality and suggestions/recommendations are feasible in Chinese Taipei, although he or she is expected to be independent from Chinese Taipei government throughout the exercise.

Scenarios of hypothetical supply emergency situation will be developed both for oil and gas by APERC and review experts. The contents of scenario would be kept confidential before the exercise. In other words, the OGSE in Chinese Taipei is expected to be a 'blind' type exercise, in which participants learn hypothetical supply disruptions on the day of exercise without prior notice.

In general, the exercise takes three days. The agenda would be decided according to the availability of participants and experts, but standard draft agenda are as follows:

- 1) The morning of the first day: APERC presents OGSE overview and the Oil and Gas Security Exercise Model Procedure (OGS-EMP); Chinese Taipei government presents their energy policy and response mechanism of energy supply disruption.
- 2) In the afternoon session: APERC presents the hypothetical supply disruption scenario for oil and oil products; participants discuss possible impacts and actions to be taken and then present their responses.
- 3) On the second day: APERC presents the gas

supply disruption scenario; participants discuss possible impacts and actions to be taken and then present their responses.

- 4) In the afternoon: the experts provides their tentative assessment and recommendations for the economy's responses.
- 5) In the third day, the expert review team visit facilities related to oil and gas security such as oil refinery and LNG regasification plant.

After the onsite three days exercise, the experts and APERC will compile a draft report and consult with the Chinese Taipei government to finalize it. In this finalization process, the government can carefully check the information included in the report. After the finalization, the report will be submitted to APEC EWG and published on both APEC and APERC websites.

4.3 Suggestions from Previous Exercises

Chinese Taipei can learn from Indonesia, the Philippines and Peru (and also Chile after the publication of the final report of the Chile exercise) which hosted APEC OGSE designed for a single economy. Among them, Chinese Taipei can learn most from the Philippines, as its energy situation is closer to that of Chinese Taipei. The Philippines is a net oil importer and will be a net gas importer in the near future although it is still self-sufficient in natural gas at the moment. Also, like Chinese Taipei, the Philippines consists of islands without any connection of gas pipeline or power grid with other countries.

In the Philippines exercise, for initial gas emergency situation, the review experts discussed reporting process, functional reserve market, redundancy system in the gas facility among others. Then, for successive oil emergency situation, they raised various issues including

additional supply, estimation of the impact of oil supply shortfall, alternative plans to address the emergency situation, legal framework for mandating oil companies to support the damaged company. Finally, in the face of further aggravated oil shortage, the experts pointed out critical issues such as nationwide communication campaign, cooperation framework with other economies, streamlining of the process/procedure for securing import permit. Those issues should be all relevant for Chinese Taipei in emergency situations.

The escalating crises scenarios for the Philippines Exercise were argued as too severe and somewhat unrealistic by some participants. However, Chinese Taipei will be more vulnerable in oil and gas emergencies than the Philippines which has modest oil and gas reserves. If this fact is considered, Chinese Taipei can learn very much from how the Philippines coped with the extremely hard cases. Relevant stakeholders in Chinese Taipei are recommended to read the final report of the Philippines OGSE when they decide to host an OGSE.

5. Conclusion

As part of efforts to improve energy security in the APEC region, APERC has so far organized six OGSEs between 2013 and 2019. Invaluable experiences are accumulated among several APEC economies who hosted OGSE.

Chinese Taipei is heavily dependent its energy supply on oil and natural gas. As the dependence on oil and gas will continue to increase in the coming years, oil and gas supply security is also expected to be more and more important for Chinese Taipei.

Chinese Taipei may have already established a relatively solid system for oil and gas emergency

response. However, Chinese Taipei will still be benefitted from hosting APEC/OGSE by receiving advices from international experts who are otherwise difficult to invite. By sharing experience of previous OGSE, APERC encourages Chinese Taipei to host the exercise in near future.

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與中華臺北分享亞太經濟合作組織的原油及天然氣安全演練經驗

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摘 要

本篇研究探討亞太經濟合作組織的原油與天然氣安全演練結果。該演練目的主要是強化亞太經濟合作組織經濟體系的原油與天然氣緊急反應能力與系統設計。2019年8月亞太經濟研究中心在泰國、印尼、菲律賓、澳洲、祕魯、與智利舉辦原油與天然氣演練。有些演練只限於主辦經濟體系參與，而有些演練包含一個以上經濟體系。即使中華臺北或許已經針對原油與天然氣緊急應變能力建立強而有力的系統。然而如果中華臺北能夠主辦原油與天然氣安全演練，則將有難得機會邀請國際專家提供寶貴建議。

關鍵詞：能源安全，安全演練，原油與天然氣緊急事件，緊急反應

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