

**KAS RECAP Publications 2019**

# **Carbon Markets and the Electricity Sector**

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**Issues, Opportunities, and Priorities for East Asia**

**Extended Report**

**Bangkok 20-23 March 2019**

## 20 MARCH 2019: EVENING RECEPTION

**Prasertsuk PATOONSITTICHAJ** (TGO) and **Dr. Peter HEFELE** (Konrad-Adenauer-Stiftung RECAP) delivered welcome remarks to the guests.

**Dr. Felix MATTHES** (Öko-Institut e.V.) delivered the keynote address which discussed designing energy & climate policy at the intersection of various (energy) megatrends, including liberalisation (or restructuring), deep decarbonization, digitalisation and decentralisation, infrastructure dependency and sector integration. He highlighted the key issues of the decarbonization: the decarbonization policy planning needs to address short, medium and long-term targets, and identify which strategies and implementation mechanisms are needed. It also needs to pave the way for the sustainable options, design the exit game for the non-sustainable assets, trigger the necessary infrastructure adjustments with sufficient lead times, and make innovation work in time. He analysed the promises and realities of the carbon pricing and the energy sector framework. Furthermore, he demonstrated the relationships between the abatement potential and abatement costs, and then he concluded as that the policy mix should be developed rationally and carefully.

The panel discussion on the topic of “Decarbonizing East Asian Energy” was chaired by **Prof. Piti EIAMCHAMROONLARP** (Chulalongkorn University). **Dr. Cyril CASSISA** (International Energy Agency), **Mr. Pakawee SILPANON** (Electricity Generating Authority of Thailand EGAT), and **Mr. Aloysius Damar PRANADI** (ASEAN Centre for Energy) discussed about practical issues from their different perspectives:

Mr. Pakawee SILPANON (EGAT) said that the active role of EGAT in carbon markets would be responsible for setting up a platform to share knowledge with other power producers, enhancing energy security, making efforts to achieve the emission reduction targets, as well as acting as the regulator and decision-maker. Mr. Aloysius Damar PRANADI introduced the 5th ASEAN Energy Outlook (2015-2040) and concluded that energy demand will considerably increase, expecting economic and population growth materialises as targeted. Fossil fuels remain the main sources but national and regional efforts slow its growth while more renewable energy are penetrating. If efforts to integrate renewable energy in the power mix are combined with continuous efforts to enhance energy efficiency, the required investments for both will significantly decrease in the long term.

## 21 MARCH 2019: CARBON MARKETS AND THE ELECTRICITY SECTOR – ISSUES, OPPORTUNITIES, AND PRIORITIES FOR EAST ASIA

### Introduction by William ACWORTH

Why emissions trading:

- Place a quantity constraint on emissions
- Achieves emission reduction targets at least cost (Static efficiency - consumption and production, Dynamic efficiency - investments, decommissioning and innovation)
- Sets in place a clear reduction pathway and "communicates" to investors that high emission investments will not be profitable over the long run.

ETS can deliver (in theory) an economy wide price signal in:

1. Production
  2. Consumption
  3. Investment
  4. Innovation
- 
1. Low Carbon production (dispatch)
    - Can help swap priority of dispatch - less carbon intensive production goes first
    - Increases marginal cost of electricity
  1. Low Carbon investment
    - ETS will make investment into low carbon assets more profitable
    - Etc.
  1. High Carbon decommissioning
    - ETS will make modernizations to high carbon assets less profitable
    - Etc.
  1. Low carbon consumption
    - Reduce consumption, increase efficiency
    - Etc.

Emissions trading with regulated retail prices

- Significant mitigation could come from demand response, but...
- Demand response will depend on whether the allowance price is reflected in end-user costs and whether they have the flexibility to respond to price changes
- Most retail tariffs will reflect average allowance costs at best
- Large consumers that participate in competitive wholesale markets will be exposed to an allowance price.
- Dynamic pricing could reflect allowance prices in retail tariffs but there are challenges (price caps, energy taxes)

Emissions trading with regulated wholesale prices

Wholesale markets are essential for carbon price to reach investment, dispatch and pricing decisions.

- Tariff methodology and structure is critical - recovery of operating or capital costs?
- What constitutes "costs" (actual or opportunity)
- Allowance allocation combined with tariff structure will be crucial.
- Price caps - missing money and merit order distortion.

Carbon markets and regulated investments

- Regulation driven not by market signals, but top down
- Fixed revenue stream for high carbon assets (Long Term PPA, Tenders, capacity markets)
- Utility makes investment proposals, regulator approves
- Investments are not made based only on market price signals

## Carbon Markets and Electricity Dispatch

- Limited role for a carbon price when dispatch is based on dispatching authority's concerns for stabilization and reliability
- Etc.

## Conclusions:

ETS is most effective in liberalized markets

ETS can still be effective under different forms of regulation, but need to be carefully designed

ETS must be embedded in a credible long term reduction framework

## Comments & Q (no names)

Mr. HONGO

- Gave praise to the presentation on being very insightful from the generation side of things.

**Q.**

Carbon markets are very politically sensitive - what is the tenability of launching a carbon market?

**A.**

There are very big differences between the wholesale market and retail market - many things can be done to reduce or prevent the impact on electricity prices to consumers and changes should only affect the wholesale market.

Mr. MATTHES

- Stabilization and balancing of markets depends on what part of the market supports the integration costs. Carbon pricing is only one aspect of this, it is a commodity.

## Group discussions

### Dispatch group:

- Economic dispatch is important for a good market but it is not the case in many Asian countries.
- Korea has an administrative dispatch system, but they have started some environmental dispatch policies.
- China is in the process of reforming the power sector, very similar to the Korean system of authorities. No principle - many companies have many generators and generate how much the authorities they them to generate.
- Reforming is improving the market's decision in dispatch now - half of the demand in Shenzhen is based on the market now. China had an investment model where you can calculate the how many years you need to recover your investment.
- Emission factors for industry are important but it is the same for every area. So China hopes to reform the grid in that the consumers can choose where they can buy the electricity from so they can have individual emission factors.
- Carbon market is separated, cannot see on how the carbon pricing affects the consumer.
- ETS in China is focusing on the efficiency - whereas China's pollution reduction is reliant on equipment
- China's efficiency is already quite high - the margin for improving efficiency is small now
- China is promoting grid stability and grid security as a priority.
- Continuous Emissions Monitoring Systems - China is just introducing it

- In the Philippines they have green dispatch - variability which has brought concerns to grid stability. Independent market operator uses merit order dispatch. Prices have actually gone down but only 5-10% of users have benefitted as many have bilateral contracts.
- Japan's feed in tariff system are not doing well because of dispatch priority issues.

### Investment group

- ETS originally was only to reduce emissions, but it failed in the EU in 2009 as the market crashed
- Practical system of design is an ETS and a carbon tax
- ETS in EU makes it affect the whole investment because of the allowance costs
- China only 5% max. if to buy allowance pass the free allowance - not effective to drive low-carbon investment
- Problem in the EU on the outset was that the supply side was fixed by the government, but demand is changing constantly. Cannot react to shocks to the market.
- There needs to mechanisms in place to adjust supply - to improve stability of the price of carbon so it sends the right investment price signals
- If the actual price of carbon is lower than the price of RE energy, then no or little shift towards investing in low-carbon assets will be done.
- Can ETS be useful in highly regulated investment markets?
- National long-term planning should not affect ETS's ability to affect investment decisions
- Vietnam's local authorities in regions have lots of say in what energy plant to build - but is it the government that is making the decision rather than ETS?
- China's government has standards for investments, much harder for coal to be approved than RE
- Prices of carbon price need to be high and stable enough in order to drive investment.

### Wholesale market

- For China you can only sell electricity to the grid company mainly
- However, there are pilot schemes in place for different regions - some competition rates are up to 40-50%
- Vietnam has one monopolistic buyer for electricity, there is a spot market on wholesale beginning but small
- In Philippines there is a liberalised market - bilateral contracts between generators, distribution companies and spot market. Many utilities only use bilateral contracts. The price of bilateral contracts is auctioned off rather than being affected by the spot market price like in the EU.
- Cambodia - energy is controlled by rainy season or dry season. Rain - hydropower, dry - coal. Intense centralized system.
- The opposite of wholesale market is curtailment - now the wholesale market has driven to shorter, shorter contracts (15 minutes).
- Wholesale markets structure is decreasing the risk of developers for RE generation in not making it economically viable.
- Spot market could lead to futures market - in Germany you can start to get wind futures.
- In Singapore, spot market prices are every 30 minutes. Problem is when the wholesale market prices are lower than generation costs.

### Dispatch group

Mr. ACWORTH led the dispatch workshop and asked participants to provide input on the experience and form of dispatch used in different Asian regions. Within Korea, dispatch is conducted on a cost basis with a framework for shadow price for environmental dispatch, which is quite different to how it was done in the European carbon market.

In the Chinese context, Professor DUAN remarked that the central authorities are still in the process of reforming dispatch, though there was no “real” or guiding principle as generation is still largely dependent on the authorities. Deregulation has taken place but varies widely within different regions. In Southern Provinces the market places a large role, such as Guangdong and Shenzhen.

In the Philippines, there is a policy of must dispatch for newer renewable energy sources, and priority dispatch for older renewable energy sources such as geothermal. However, the market is relatively distorted as only 5-10% of energy is purchased from the spot market whereas the rest are formed from bilateral contracts.

In Australia, economic dispatch is imposed but connectivity across grids actually takes advantage of the dispersed nature of renewables and mitigated some of the issues related to variability.

During the discussions, whether air regulation could substitute ETS (if it is inefficiency) was raised as the participants remarked that air pollution regulation was very effective in China. However, it was mentioned noted that the ETS focuses on efficiency and therefore has a different policy target. Dr. EWING also noted that the transition in UHV within some regions would also aid dispatch reform by identifying areas to move production zones for RE and enable the transfer of electricity over large distances to demand centres.

## **21 March 2019: SESSION 2: EMISSIONS TRADING AND INTERACTIONS WITH EXISTING ENERGY POLICY INSTRUMENTS**

### **Prof. Anatole BOUTE and Hao ZHANG (Chinese University of Hong Kong): Adjusting the ETS to “companion policies”: the role of carbon price stabilization**

Other than ETS, there are some measures aiming at greenhouse gas emission reduction, for example, renewable energy support schemes, emission performance requirements, and forced shut down of installations such as coal-fired power plants. These measures are articulated by “companion policies” and have impacts on the surplus of allowances under ETS, and they might cause the “waterbed effect”. Regulatory actions such as adjustment to carbon cap, intensity-based allocation and *ex post* adjustment, market stability reserve, cancellation of allowances, price ceiling or floor would be in response to stable the carbon market. These measures might cause the issue of regulatory predictability and be seen as the regulatory and political risks, which will impair the market efficiency and damage investors’ confidence. They have the possibility to raise the problem of property right, legal certainty and regulatory independence. The waterbed effect caused by companion policies might be absorbed by stabilizing prices, but state has to be careful because there is possibility that the attempts to stabilize prices would destabilize the ETS and undermine the regulatory certainty needed to invest. Instability and uncertainty can be limited by price-based mechanisms and clear rules and independence.

### **Dr. Cyril CASSISA (IEA): ETS role and policy interactions**

Carbon pricing policies play a key role in promoting low carbon technology development but also in encouraging energy efficiency for achieving the steep decline in emissions seen in the Sustainable Development Scenario. Almost 20% of global GHG emissions are covered by a carbon price, of which ETS accounts for three-quarters. But energy-related CO<sub>2</sub> emissions are still increasing and will reach an historic high in 2018. There are multiple objectives driving energy transitions, including greenhouse gas

reductions, lower energy costs, jobs and growth, energy security and air quality improvement. Energy sector transitions are critical for achieving greenhouse gas reduction targets. A broad basket of policies is relevant for energy transition and interacting with each other, such as the carbon pricing, energy efficiency support, supporting markets and infrastructure, air quality regulations, fossil fuel phase-down, and renewables support. The role and function of the ETS varies across jurisdictions. Some states define ETS as the cornerstone of the greenhouse gas emissions reduction, while some others consider it as complement to the environmental tax, renewable energy support and other policies. In broader emissions reduction targets, ETS contribute to achieving economy-wide greenhouse gas targets, such as the National Determined Contributions. In addition, the role and functions can evolve over time. Therefore, policy overlaps and interactions need to be taken into account for effective implementation. The design of ETS should consider how it will interact with wider energy transitions policies. The interactions might occur in different sectors responding to different targets and policies, for example, the renewable energy and energy efficiency policies, as well as the flexibility mechanisms; the interactions may also occur across jurisdictions. The design of EIS should also consider how it will address regional distributional impacts. The EU-ETS is a major policy in EU climate governance. It is in line with EU international commitment on climate change. It is defined as a cornerstone policy and there is regular ex-post assessment of the impact of the EU-ETS on other policies. Inspirations can be drawn from international experience, for example, Canada's approach to carbon pricing is to balance federal coordination with sub-national autonomy. We can learn from Canada that carbon pricing is critical to driving energy transition, but other policies are needed. In conclusion, carbon pricing plays a critical role in the policy mix for energy sector decarbonization. But understanding its role, and how it layers with other policies, can be complex and shall be carefully considered. Having clarity on what the ETS is intending to achieve is critical as it will affect design choices. Lastly, IEA seeking for deepen its cooperation with emerging economies.

### **Claudia GIBIS (German Emission Trading Agency): Interaction of EU ETS with complementary climate and energy policy instruments**

The ETS Authority (DEHSt) is mainly responsible for the implementation and enforcement of EU ETS in Germany, which includes free allocation, auctioning, approval of monitoring plans and emission reports, penalties, account management in registry. It is at the German Environment Agency (UBA), which belongs to German Ministry for the Environment (BMU).

Ms. Claudia GIBIS started the presentation by the introduction of the basic information on EU ETS, which demonstrated that ETS is no silver bullet and the complementary energy and climate policies are needed. ETS is a cornerstone of EU's climate policy, but decarbonization needs other instruments, too. The right mix of instruments is crucial. But additional climate policies can lead to the "waterbed effect". For example, the targeted coal phase out policies lead to a structural demand shift in EU-ETS, and the same as renewable energy and energy efficiency promotion. This will increase the emissions elsewhere and weaken the carbon price signal. Therefore, proper analysis with economic modelling is needed and the impacts of various co-existing instruments must be considered. However, this was missed in EU-ETS. So caps should be adjusted and interim measures are needed. EU has reformed the ETS by cutting auctioning volumes through back loading from 2014 to 2016, and market stability reserve from 2019 on. However, the market stability reserve can only mitigate, but not prevent waterbed effect. From 2021 on, Member States may voluntarily cancel their national auctioning volume in order to compensate for closure of fossil power plants. But in the mid- to long -term, the market stability reserve and voluntary cancellation cannot substitute a more ambitious cap that takes into account the mitigation impact of complementary instruments.

**Dr. Le Viet PHU**, from Fulbright School of Public Policy and Management in Fulbright University Vietnam, introduced Vietnam's carbon market experience and relations with other energy policies. Actually, Vietnam has not implemented any ETS policy yet and has gained important experience from other carbon offsetting scheme such as CDM and Nationally Appropriate Mitigation Actions (NAMAs), with an eye on future ETS. ETS policies, if introduced, are complementary to various existing efforts to improve the energy sector.

Whereas Vietnam experienced a rapid emissions growth, as well as economic growth over the past two decades, which led to a significant demand for energy and the use of fossil fuel, its hydropower would decrease from 40% in 2005 to 10% in 2030, but the consumption of coal and gas would increase. Due to the low energy price and the development of high energy intensive industries, Vietnam has low industrial energy efficiency.

However, Vietnam has Green Growth Strategy with targets of reducing energy consumption per units of GDP by 2.5-3% per year to 2020 and reducing GHG emissions by 2-3% per year from 2020 to 2030. It also has special Nationally Determined Contribution (NDC) targets.

As the country with the 4<sup>th</sup> largest portfolio of CDM projects worldwide, just after China, India and Brazil and before Mexico and Malaysia, Vietnam has had limited success in financial terms with the CDM market. But Vietnam gained significant experience with the procedures including MRV of the CDM and of voluntary carbon markets.

Moreover, Vietnam intends to initially apply MBIs to select sectors with a view to broadening the scope over time, with the aim of achieving broad based carbon pricing over time. Key criteria used to select sectors is the readiness for market instrument(s), which include the responsiveness to price signals within the sector, market concentration, data reliability, ability to build on relevant existing initiative, interest of stakeholders, GHG mitigation potential and potential for win-win options, alignment with country's SD priorities, and scope of PMR and overlaps with other programs/projects. Potential sectors to be considered for MBIs include steel, solid waste management, power (EE of demand side) and transport.

From the perspective of Vietnam's Renewable Energy Development Strategy, its proportion of RE in total primary energy consumption in 2015 is about 31.8% and is expected to be about 31.0% by 2020, about 32.3% by 2030 and to have increased up to about 44.0% by 2050 with special supporting policies, such as FIT policies, offtake PPA, preferential access to land, renewable portfolio standard, net-metering for rooftop solar PV, tax incentives and import duties exemption, etc.

In general, Vietnam does not have ETS now, but ETS is one of the options for Vietnam in the future.

**Teresa Ira Maris P. GUANZON**, the director for the energy committee, office of Senator Win GATCHALIAN, discussed the ETS in the Philippine and the electricity market.

Philippine enacted the Electric Power Industry Reform Act in 2001 to liberalize the power sector, divest ownership by the Government, unbound the previously vertically integrated power sector and regulate the generation, transmission, distribution and supply of electricity. The main issues dealt by this Act include the centralized "planning" with varying policy directions, no command and control, no performance standards (except for Clean Air Act) and the PPA auctions, etc. With the effects created by the Act, the flexibility in determining investment is increased and the recovery of investment could be gained through PPAs. Considering the current situation, the market design of the country is crucial, which involves the target of the design, the allowance distribution and regulation of allowance in circulation.

In addition, based on its special backgrounds of renewable portfolio standard and green energy option, Philippine enacted the Renewable Energy Act in 2008. Based on this Act, the development of renewable energy could be a complementation to ETS mechanism. There are also possible waterbed effect and

possible source of offsetting credits in this energy sector. Furthermore, this Act stimulate the interaction between green energy market and ETS.

Other than the abovementioned acts, Philippine also has other policy instruments, such as the Clean Air Act, the Energy Efficiency and Conservation Act and the Electric Vehicles (Proposed), etc.

In general, the overarching issues faced by Philippine are the coordination of targets for all policy instruments, the monitoring and verification for all policy instruments and the economy-wide effect of all policy instruments in place. For example, the effect of these instruments will have on investment, energy prices and the development of grid.

**Prof. DUAN Maosheng**, from Tsinghua University shared his opinion on the coordination of China's national ETS, its energy efficiency ("EE") and renewable energy policies.

There are several reasons that China needs coordination. Both energy efficiency and renewable energy policies in China serve many objectives other than GHG mitigation and could be very different from ETS in terms of mitigation cost-effectiveness. The target sectors and entities are almost the same for ETS and EE policies. Their policy objectives are highly interconnected, especially energy saving targets and GHG mitigation targets. Both EE and RE projects are important sources of offsetting credits that could be used in the ETS. The main coordination objectives are to avoid contradiction and achieve complementation.

In China, all enterprises covered by the national ETS also assigned mandatory energy conservation targets. EE policies will affect the effect of ETS and vice versa. In the case of substantial output increase, "double control" policy will prevail and ETS may be redundant. In the case of substantial output decrease, ETS will prevail and "double control" policy may be redundant. Transaction of allowances will not affect the achievement of "double control" targets of entities. Inter-regional transaction of allowances will not affect the achievement of energy conservation targets of regions. ETS incentives covered entities to reduce emissions through all possible means, while under the EE policy, accounting does not include energy saving induced by the change of products structure, etc. Transaction of allowances will not affect the achievement of "double control" targets of entities. Inter-regional transaction of allowances will not affect the achievement of energy conservation targets of regions. There is a possibility of unnecessary double incentives to energy conservation efforts. Overlap of information reporting requirement of two systems and different requirements.

RE policies in China includes the renewable portfolio standard (RPS), feed-in tariff or premium payment and the trading of green certificates. These polices could be possible source of offsetting credits for the national ETS.

The coordination work will have many significant effects. It emphasizes the importance of top-level design in the process of comprehensively deepening reform and finds out the vested interest as a crucial barrier. To carry out the coordination, the stakeholder consultation might be a mandatory process in the legislation process and the coordination at the technical level could be a more feasible choice.

### **Student presentation**

**Natchaya PICHETSATHA**, LLB student from Faculty of Law in Chulalongkorn University, introduced the role of the energy regulatory commission in supporting carbon market in Thailand. The electricity system could promote economical and efficient use of energy, renewable energy and energy that has less impact on the environment.

**Podhsavee BHOTIRUNGSİYAKORN**, LLB student from Faculty of Law in Chulalongkorn University, introduced the electricity generating authority of Thailand and carbon market in Thailand. The electricity generators in Thailand include EGAT, independent power producers, small power producers and foreign power producers. But EGAT has a significant influence on electricity market and carbon market. At present, EGAT has issued various clean development mechanism projects and Thailand voluntary emission reduction projects to reduce carbon emission.

**Kritsakorn MASEE**, LLM student from Faculty of Law in Chulalongkorn University, introduced Thailand's voluntary emission trading scheme and domestic carbon market and the way forward for Thailand's challenges and opportunities in battling with climate change through institutional and legal frameworks.

**Liu SHAN (Chinese University of Hong Kong)**: introduced the development of China's third-party access system to natural gas network. China is stepping into a non-discriminatory third-party access system to natural gas networks. The parties and service scopes involved in the access are extensive. But there are still some shortcomings. For example, there is no independent legislation, network operators can only open to third parties when there are surplus transportation capacities, and whether or not to accept the application for access to the networks is determined by the network operators at their solo discretion. Therefore, the degree of openness of the pipeline networks in China is insufficient at present.

**WU Lan (Chinese University of Hong Kong): Third Party Access to Electricity Networks in China – How is the Third-Party Access to Electricity Networks Regulated in Chinese Laws?**

The non-discriminatory third-party access obligation has not been paid enough attention in China. Existing Chinese laws do not explicitly recognise the non-discriminatory TPA obligation and it is scattered in legal documents and not regulated sufficiently. The lack of judicial remedy approaches for the refusal of access and the fragmentation of regulations on TPA call for the update of the laws, which should incorporate the regulation on TPA in a more sufficient way. By doing so, the non-discriminatory TPA obligation will become clear and gain a firm legal foundation. And this is of great significance for introducing competition in the electricity market.

**Dixon Pascal LAI (Chinese University of Hong Kong): Solving China's Renewable Energy Curtailment**

The renewable energy curtailment rates are starting to fall steadily as part of China's recent policy initiative. Wind-power curtailment should be 10% in 2019 down from 15% in 2012. There are some options to address the issue of renewable energy curtailment. In terms of the unconnected capacity, coordination between NDRC and NEA are needed. Thermal generators should be compensated for having 'spare capacity' to cover the gaps left by renewable energy production, especially during peak hours and promoting renewable energy usage by compensating 'spare capacity' of renewable energy producers can help. Setting up an independent market for renewables, and adopting carbon emissions trading or carbon taxing can be useful to lower the cost of renewable energy and reduce the curtailment rate. Lastly, building up the 'Economic Exchange' system in which provinces would import energy between each other when their generation costs are unequal. Energy storage facilities should be further considered for renewable energy generators where intermittency and variability in generation is large. To ensure the available capacity is not wasted can help to increase the reliability of solar and wind renewables.

## **Quentin CHEUNG (Chinese University of Hong Kong): China's Green Dispatching in China- challenges and opportunities?**

Dispatch remains fundamentally administrative which has contributed to high levels of curtailment of renewable energy sources amidst legislative and policy guarantees. A merit order in the traditional sense does not exist in China due to the lack of deregulated energy markets. Rather variations and experiments in different dispatch have allowed the replacement of small scale, inefficient units with larger efficient ones, and also promoted the replacement of cleaner installations. Pilots have also introduced some economic dispatch elements. However, some of the protections granted by historical production rights may prevent the introduction of new entrants such as wind farms or solar power plants. While national level policy (which supersedes local law) has been implemented to promote zero emissions installations, but the reality of implementation and the desired effect of grid parity has yet to materialize.

## **22 MARCH 2019: CARBON MARKETS AND THE ELECTRICITY SECTOR – ISSUES, OPPORTUNITIES, AND PRIORITIES FOR EAST ASIA (CONTINUED)**

### **What are the key impediments to an East Asian Carbon Market?**

Dr. EWING expressed that linking markets across different jurisdictional boundaries possesses an appealing logic as there are several benefits to expansion of an ETS beyond national borders. Firstly, expansion could lead to the inclusion of more participants, which enhances scale and efficiency as there is a greater pool of matching agents, players and firms who have different marginal abatement costs than at home. Expansion across borders could also improve the resilience of large players to price shocks; and as improve costs which provide ancillary benefits to clean energy transition. There are also co-benefits for conventional pollution and linkage could also reduce leakage by removing or reducing the incentives for companies with multi-national operations to move to locations with less environmental curtailments on their behaviour.

Nevertheless, several challenges remain. Heterogeneity within East Asia such as historical animosity may prevent effective coordination although climate change is a significant political topic and mitigation is linked to economic performance. Competitiveness concerns over the pricing of externalities also exist as some countries have lower abatement costs than other regions. Trade contentions may arise depending on the how embedded carbon is perceived and adjusted for the importing country. All in all, increasing dialogue signal global leadership within environmental governance.

There are also existing examples of ETS within East Asia. This include China's ETS, Korea's KETS (which the government has made a pillar of their climate change policy), and experimentation in India along with Singapore's carbon tax efforts. Japan has a more differentiated experience, and its subnational, offset and joint credit markets give it more experience in market development which lend to greater opportunities for integration or rollout of a national system; which has already been investigated.

Potential linkage possibilities could lie where there are low barriers to entry, tapping into 3<sup>rd</sup> parties or organizations such as the world bank, or in restricted linkage which place quotas on exchange (such as a discount rate in trading). Informal reciprocal linkage in accounting and MRV could further lower the barriers to entry and allow companies to trade without the use of formal treaties. These possibilities however must be reconciled with "bad pennies" such as the possibility of undermined confidence in MRV, lower levels of trust (especially if there is a discount/ exchange rate), decreased robustness of the credits themselves, ambition inconsistencies, shock risk in a linked market, and financial transfers (where capital used for emissions reduction is sent to another jurisdiction for carbon reduction that is hard to sell politically).

Linked ETS markets are inherently challenging as national ETSs are designed to fit national circumstances. Linkage and harmonization therefore have to take into consideration a number of different considerations and factors. Currently, early stage conversations between different East Asian countries can facilitate these efforts.

### **Financing low-carbon investment in Asia**

Dr. PITI presented on the use of blockchain and financing low carbon investment in ASEAN, highlighting the methods to impact private participation and increase investment for the sector. PITI first introduced the regulatory regime for investment within Thailand. Within Thailand, the government's power development plan (2018) is a key as there is a single buyer model. A feed-in-tariff is used with the main regulatory authority being the ERC, EGAT as a power buyer and with private operators united as a group (organized as an industrial agency in Thailand).

Financial institutions as a result always check a PPA before providing loans to ensure the financial viability of the project. They will usually scrutinize the project development's special purpose vehicle ability to pay a loan plus interest.

Multiple financing options were also explored. In Thailand, one of the predominant financing method was the Green bond, offered by the Thai Military Bank. Other Thai Commercial banks are ready to launch green bonds. More unique financing instruments have also been explored, such as the use of carbon credits (or anticipated carbon markets) to finance reforestation projects (as offset sources). Kbank supported such a program launched with T-VER (voluntary emission reduction program).

In the digital era, blockchain carbon credit trading is being explored such a Reneum, which is a company that uses digitally stamped and secured contracts to create RE certificates to be registered on an online platform via blockchain. Trading of carbon credits online may expand and increase market activity as there is no "jurisdiction" and Thailand digital currency tokens are legalized.

During the discussion, the various merits of blockchain were discussed. Some of the benefits mentioned include the fact that blockchains can actually reduce the transaction cost with the carbon credit origination process as many claims within ASEAN regions are still made on paper. This means that process of data collection needed for verification is integrated into the credit system itself and helps the provision of digital identities needed for data to make a claim. As a result, the MRV process which normally taken care of by a 3<sup>rd</sup> party is now simplified and cuts costs as there is no need to send auditors to verify the carbon calculation process.