SECOE
SUSTAINABLE ENERGY
CENTER OF EXCELLENCE

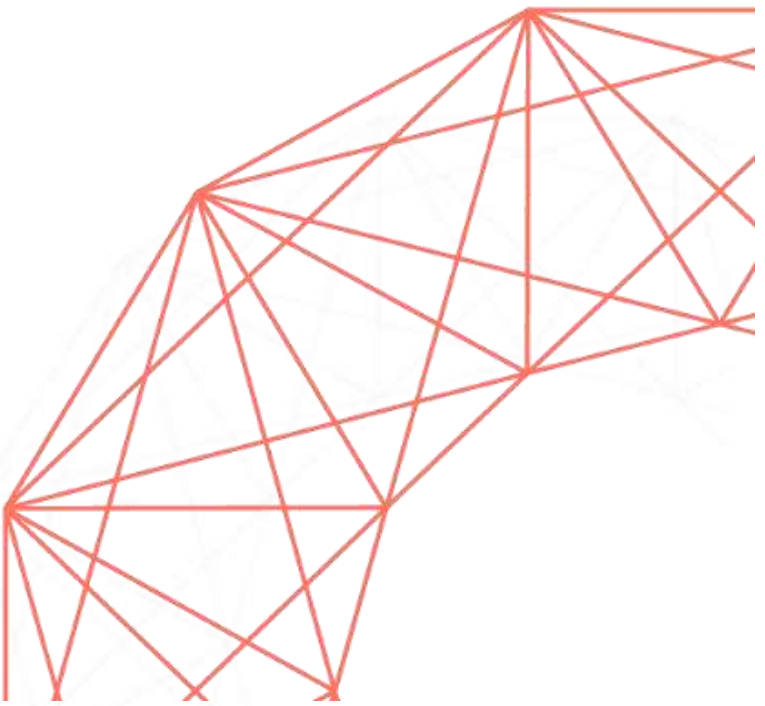
"CONNECTING POLICY, TECHNOLOGY & FINANCE THROUGH KNOWLEDGE"

Developing Electricity Markets & Reforms Workshop Report

18 – 22 April 2016

Empress 1, Level 2, Carlton Hotel Singapore

76 Bras Basah Road Singapore 189558,



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Summary of Event

This was the fifth workshop conducted under the Sustainable Energy Centre of Excellence (SECOE) which was held in Singapore from the 18th to the 22nd of April 2016.

The workshop focused on imparting knowledge to the policy makers of the members' states of the Asian Development Bank (ADB). There are 3 key focuses of SECOE which are renewable energy, energy efficiency and energy access. This iteration of the workshop primarily focused on developing the electricity markets & reforms.

16 participants from 6 countries attended the 5-day workshop which included a site visit to Ecowise Holding Ltd facility at Gardens by the Bay.

The participants were mainly from the electricity authorities in their respective countries (attendance list attached). There were 8 resource speakers. The speakers for SECOE came from organisations such as the Energetix, DNV GL, CPvT, Diamond Energy, Energy Market Company which shows the diversity of speakers coming from all around the world sharing their knowledge and expertise with the participants.

The workshop received positive response from the attendees and the presenters alike.

Outcomes of the workshop

There were many good presentations and as the participants learned from the speakers, the speakers also gained some country specific insights from the participants.

At the end of the workshop, the participants came away with some key takeaways in order for them to draft and implement energy markets reform policies in their respective countries:

1) The need to set and implement energy market policies which would allow the support of long term adoption of energy access through market liberalisation.
2) Different market mechanisms which would assist in the transition using Singapore as a study of what has been carried out.
3) They need to convince their respective governments that with the liberalisation of the energy market, it would increase competition and ensure higher levels of standards and performance.

18 April 2016 – Day 1

The workshop was kicked off with the welcome remarks from Mr. Edwin Khew, Chairman, SEAS followed by the introduction to the training programme by Ms. Kavita Gandhi, Executive Director, SEAS.

Figure 1 – SECOE participants on the first day.

The participants then quickly introduced themselves by countries. Each taking 5 minutes to give a broad overview of the current situation, regulatory environment and the gaps and challenges faced. This would allow each country participant to understand where each country is at and to take note of the lessons which could be learned.

Table 1 – Summary of the Challenges and learning lessons which participants are looking at

Country	Challenges and learning lessons
Bhutan	• Looking for an affordable & sustainable tariff • Looking to be able to export energy into the regional market as there would be expected surplus of energy through hydro resources • Seeking advice on how to structure the electricity market to increase the national revenue such as having a feasible settlement mechanism to be implemented.
Cambodia	• High hydro potential of 10,000 MW however only 13% of the resources are being utilised. • Cambodia has one of the highest electricity tariffs present • Looking on how to reduce the electricity tariff for the people • High amount of electricity generated by diesel gensets • Seeking advice on how to create a monitoring plan for energy generated and to liberalise the market to increase energy access. •

Country	Challenges and learning lessons
Nepal	• Has high amount of natural hydro resources. A study carried out in 1962 showed a potential of 83,000 MW. A revised study carried out in 2014 increased this potential to 200,000 MW. • Looking on how to export energy to their neighbours which will assist the economy and the budget of the country.
Philippines	• Philippines has a highly developed energy market. • Philippine is seeking to provide electricity to all citizens by 2020 and the challenges lie mainly in the last mile electrification. 81% of the villages are currently electrified. • Carbon credits may be a solution to assist the financing of RE projects for rural electrification.
Sri Lanka	• 99.2% of Sri Lanka is electrified. • Sri Lanka has a 15 different tariffs structure and are looking to simplify it. • The wholesale market would be able to assist in the pricing of energy.
Vietnam	• There is currently only one buyer which is the EVN which controls the energy market. • This results in the energy regulatory not holding much sway in the decision of the market pricing. • Looking to make the market more transparent and opened to increase energy access. • Vietnam has 24 trading intervals for energy. • Looking to reflect the through cost of energy pricing in the market, has great interest in how Singapore has liberalised the market.

Overview of Climate Change and the need for Clean Energy

Mr. Christophe Inglin, Managing Director, Energetix Pte Ltd presented on the need for clean energy. The presentation gave a broad overview of climate change and the need for action to be taken. Focus should be given on energy efficiency and renewable energy to mitigate climate change.

Examples of how energy efficiency is being established in Singapore is through the Building Code Authority (BCA) Green Mark Programme which trains the sector on how to do green buildings better. This has grown the number of green buildings which have been adopted in Singapore. Through this, the urban infrastructure would reduce the amount of latent heat and would in turn make the environment more comfortable.

Figure 2 – Mr. Christophe Inglin explaining on climate change and the effects seen

The topic of carbon credits was brought up as a ways and means to increase the adoption of renewable energy and energy efficiency in the developing countries. A good case was the China carbon markets which are in operation.

Singapore as a country would not be able to be 100% solar. Solar would be able to contribute to about 6% of Singapore's energy mix. One solution would be the ASEAN grid which would be able to allow the connection of different energy mixes across the varying regions.

The Independent Electricity Retailer perspective of the liberalised electricity market of Singapore

Mr. Vijay Sirse, CEO, CPvT Energy Asia Pte Ltd presented on this topic which gave a broad over of the energy market in Singapore. From 2018 onwards, residents in Singapore would be defined as contestable customers and would be able to purchase electricity from any supplier. Currently in Singapore, consumers from the commercial and industrial sector would using more than approximately SGD500/month in their bill are contestable.

Through market liberalization, it has actually helped to reduce cost for consumers in Singapore. The current electricity tariff for the non-contestable is SGD0.1768/kWh from the period of 1st April to 30th June 2016. The contestable consumers would be able to purchase at a price of perhaps SGD0.11/kWh which is much lower.

Figure 3 – Mr. Vijay Sirse explaining on the Singapore electricity market from the retailer's perspective

The key to move forward is to have technological innovations. One example was Demand response which was presented. It is a market mechanism which is operational in countries like Australia and New Zealand whereby consumers would be paid for curtailing their energy consumption.

Part of the presentation included organic PV and energy storage which garnered interest from participants from Nepal and Bhutan. The participants noted that energy storage is key to increase the clean energy mix in the country and to allow load shifting.

Introduction to Competitive Electricity Markets

The afternoon session was covered by the Energy Market Company (EMC). EMC was the company in charge of the liberalisation of the energy market in Singapore.

Mr. Tan Liang Ching, Senior VP of Business Development covered the introduction and the market reform and regulation.

Figure 4 – Mr. Tan Liang Ching bringing the participants through an example of node networks

It was brought up repeatedly that the decision maker is the key and the right policies should be implemented to ensure proper adoption. The purpose of market liberalisation is to allow the consumers to not beholden to one retailer.

Bhutan brought up that competition would be good and should be started at the generation side.

Philippines noted that the load contract is important which should be noted by the policy makers during the development phase. Another item which was brought up was on the electricity meters for small consumers would be installed in Singapore. This was carried out by generating companies. Generating companies in Singapore would install their own meters in place of Singapore Power's meters. This cost would then be factored into the electricity bill over the contract period.

Nepal raised the question on how energy pricing should be carried out. The case in Singapore is via nodal pricing, however as each country has its own transmission network, it should be looked at a case by case basis.

Nepal also noted that there are PPA challenges in the country. There are also issues with the transition to privatise the generating companies. Guaranteed generation would have to be ensured to the generating companies which could prove as a challenge.

A common question which was brought up on in the event no generating company would take up the supply of electricity to the customer, the provider of last resort would be Singapore Power. This is to ensure continuity of power supply. Although Singapore Power would be the most expensive option.

19 April 2016 – Day 2

Market Design- High Level Market Design Considerations

Market Operations – Overview of the day to day operations

The 2nd day session was carried out by Mr. Joel Tai from EMC Singapore covering a high level look at the considerations which need to be taken into account when designing a whole sale market. The afternoon session was then taking a view of the day to day operations of EMC.

Figure 5 – Mr. Joel Tai covering the high level market design considerations and Mr. Tan Choon Kiat covering market operations.

Philippines asked on who shoulders the transmission losses in Singapore which was factored into the pricing to the consumer. Philippines also noted that nodal pricing results in a higher price to consumers. Another question brought up was if there was a price difference between AC or DC in Singapore. As Singapore only operates on AC, thus there's no pricing difference.

Nepal was keen to know more on how is the electricity market was priced and how would it be structured. The electricity market in Singapore works on 30 minutes interval and EMC would be collecting all the bids from the market participants. Based on the algorithm which is ran by EMC, the price would then be determined for that segment.

Vietnam was keen to know more on the privatisation process of the Singapore market.

20 April 2016 – Day 3

Site visit to Ecowise Facility at Gardens by the Bay, Singapore

The site visit was carried to Ecowise Facility located at Gardens by the Bay. The biomass plant which is in operation is a tri-generation plant which is able to provide electricity, hot water and chilled water. This provided the workshop participants a view of a renewable energy system which is operation which may not be present within their country. As no photos were allowed within the facility, only a group photo was taken towards the end of the visit.

Figure 6 – Group photo of the participants for the site visit

21 April 2016 – Day 4

National Electricity Market of Singapore: Features and New Developments

The morning of the 4th day was covered by EMC on the features and new developments of electricity markets. This was covered by Ms. Serena Ho, Senior Economist from EMC.

Figure 7 – Ms. Serena Ho speaking on the development of the national Electricity market of Singapore

Vietnam was keen to know more on how to privatise generating companies as currently the companies are state owned enterprises which presents a challenge for reforms. Another item of concern was metering. This is as the generating companies are being privatised, which entity would ensure that the meters would be installed at the end users? The reference in Singapore is that the generating company would take charge of the meter. Another item is the vesting contract as they would be looking at a long term selling contract. Companies may not be so keen to participate in the market without a vesting contract.

Sri Lanka noted that energy security is key for the country and the way for this is through renewable energy.

Philippines noted on the point of Sri Lanka and mentioned that renewable energy such as solar is good, however the challenge is the intermittency of it. Thus battery storage would be an ideal solution to even the load peaks. One item brought up was why wasn't there a forecast presented for Singapore. The forecast was done through the half-hourly retail intervals.

Bhutan was enquiring on who maintains the transmission lines and substations. This was done through Singapore power and this amount is factored into the energy price.

Demand Response

One of the key items which is being developed in Singapore is Demand Response which is already an ongoing mechanism in Australia and New Zealand. This segment was covered by Mr. Dallon Kay, President & CEO, Diamond Energy.

Figure 8 – Mr. Dallon Kay covering demand response

Nepal was keen to know more how it works as they defined it as being a forced outage. However, this was clarified that the individual would have to opt into this scheme and would be paid for reducing their energy consumption. Another question was how to ensure that the individual would reduce their energy consumption during that period. The company would have to have a system installed at their site to shut down their equipment during the required period.

Integration of Intermittent Energy Sources like solar & wind into the grid

This segment was covered by Ms. Rui Liang, Consultant with DNV GL. With the progress of the discussion through the previous days, it was reiterated that the key was having an energy storage solution to even out the energy peaks.

Figure 9 – Ms Rui Liang, DNV GL explaining to the participants on the nuances of intermittent renewable energy

22 April 2016 – Day 5

The final day involved all the participants presenting on what they have learnt, sharing lessons with one another and future actions to be taken.

Table 2 – Key Lessons learnt & future actions which participants are looking to carry out.

Country	Key Lessons Learnt & Future Actions
Cambodia 	• Energy Efficiency and Renewable Energy are keys for the country. • Incentives for Renewable Energy • A spot price market would be needed in the country. • There is a high potential for hydro in the country which is up to 10,000 MW. • Industry reform would be needed. • There are political challenges for the development of the energy market in the country.
Nepal 	• Biomass plants are a viable solution for energy generation in Nepal. • 100 MW of solar for power generation can be achieved. • Energy act to be developed to allow power trading. • To have grid connected batteries to smoothen energy peaks. • High level of losses are experienced and this has to be rectified. • To have a trading system with the neighbouring countries. • Demand response is a solution which could be applicable to the country at a later stage.
Philippines 	• Energy efficiency is of growing importance to ensure that less power plants are constructed. • Demand response is a solution which could assist. • Divestment of all government-owned power plants to the private sector. • Operators are currently in transition. To reduce conflict of interest, an independent office will be set up.

Country	Key Lessons Learnt & Future Actions
Vietnam 	• Vietnam would be implementing nuclear power in 2025. The plant capacity would range from 2,000 to 4,000 MW. • There is a disconnect between the private sector and the government and this has to be changed. • Government still owns 51% share of generating companies. • There has to be an unbundling and privatisation of the energy market. • March 2016 to privatise DPM. • SMO system security is to be implemented. • Nodal pricing would be considered in the future as currently it is operating on a zonal pricing model.
Sri Lanka 	• The energy market has to be simplified. There are currently 15 different tariff rates and this has to be reduced. • For distribution licensees, two accounts are needed. • There is currently excess amount of administrative work which is required and this is to be streamlined.
Bhutan 	• Renewable Energy, Energy Efficiency and transport has to be coupled together. • Market liberalisation is required. • There has to be political and policy coherence for the energy market to develop. • Bhutan view is on a nearer view than on a further view at the moment. • The benefits of the decisions must be given to all citizens at an affordable price.

Feedback & Conclusion

At the end of the workshop, the participants' response was overall positive in all aspects of the programme on Developing Electricity Markets & Reforms Workshop.

The participants highlighted at the end of the workshop that they would be pleased to have more support for policy capacity building workshop in their countries for topics beyond the electricity market to areas such as renewable energy and energy efficiency. Participants are looking forward to have greater support after SECOE from ADB and SEAS to help support their governments towards a sustainable future.

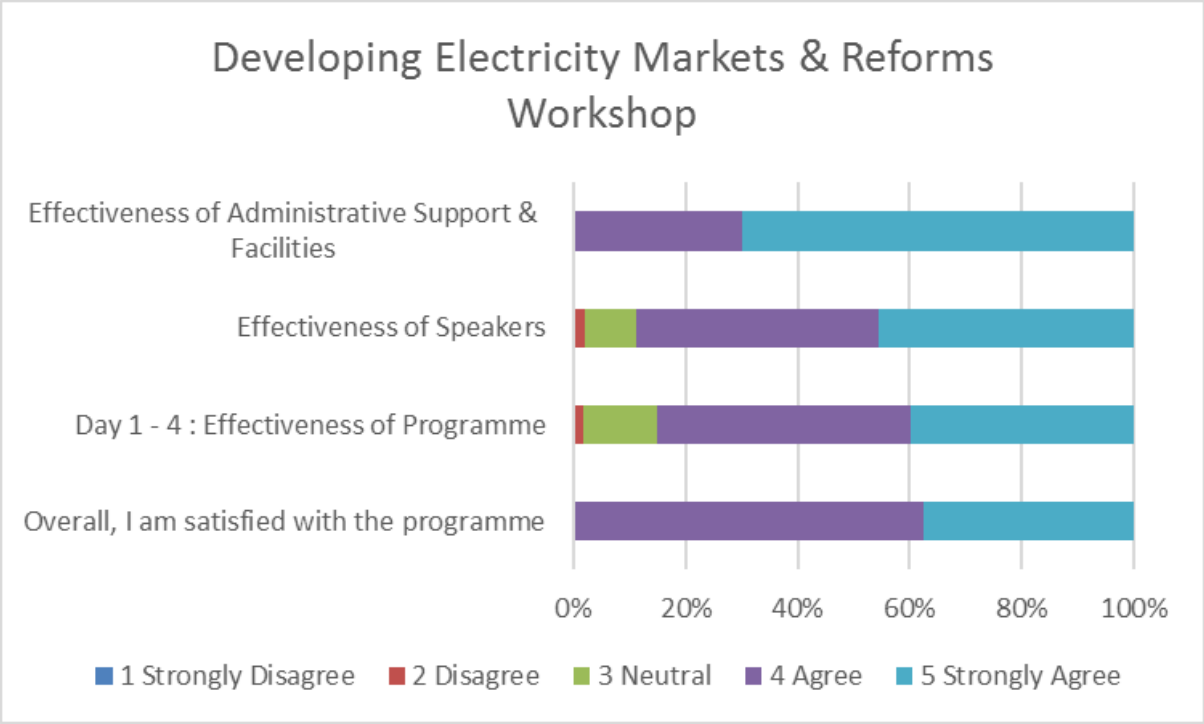

Figure 10 – Feedback from participants who had attended the workshop

Many look forward to future topics of the Sustainable Energy Centre of Excellence on renewable energy and Energy Access, and appreciate the training and knowledge assistance that the centre will be able to provide them.

Annex 1: Programme

Time	Programme Day 1: 18 April 2016
8.30 – 9.00	Registration
9.00 – 9.10	Welcome Remarks 1. Edwin Khew, Chairman, Sustainable Energy Association of Singapore
9.10 – 9.20	Introduction to Training Programme - Introduction of Sustainable Energy Centre of Excellence (SECOE) - Introduction to the Developing Electricity Markets & Reforms: Overview and Objectives Kavita Gandhi, Executive Director, SEAS Facilitator: Yeo Kim Dek, Business Development Manager, SEAS
9.20 – 10.00	Speed Networking with Participants • The objective of this session will be for people to get to know each other and to provide a baseline of information on the electricity markets in each country • Self-introductions to the group by all participants (max. 30 seconds each) • Country introductions – "5 Minutes of Fame". A designated representative from each country will BRIEFLY present the current situation in 5 slides with the following topics: **Slide 1:** Electricity Market overview in your country Slide 2: Regulatory Environment for Electricity Slide 3: Gaps and Challenges (max. 5 minutes each and NOT MORE THAN 5 Power Point slides) Facilitator: Yeo Kim Dek, Business Development Manager, SEAS
10.00 – 10.30	Group Photograph & Coffee Break
10.30 – 11.15	Overview of Climate Change and the need for Clean Energy Christophe Inglin, Managing Director, Energetix Pte Ltd
11.15 – 12.00	The Independent Electricity Retailer perspective of the liberalized Electricity Market of Singapore Vijay Sirse, CEO, CPvT Energy Asia Pte Ltd
12.00 – 1.30	Lunch
1.30 – 3.30	Introduction to Competitive Electricity Markets i. Understanding Electricity Markets A brief introduction to the basic physics, challenges and principles surrounding the creation and transportation of electricity Tan Liang Ching, Senior Vice President – Business Development, EMC Pte Ltd
3.30 – 4.00	Coffee Break
4.00 – 5.00	ii. Market Reform and Regulation

	Justification of competitive markets through basic economic principles as well as real world experiences Tan Liang Ching, Senior Vice President – Business Development, EMC Pte Ltd
	End of Programme
Time	Programme Day 2: 19 April 2016
8.30 – 9.00	Registration
9.00 – 12.30	Market Design High Level Market Design Considerations A high-level look at the considerations needed to be taken into account when designing any competitive wholesale electricity market. Joel Tai, Business Development Manager, EMC Pte Ltd
12.30 – 2.00	Lunch
2.00 – 5.00	Market Operations A general overview of the requirements surrounding the execution of a competitive wholesale electricity market ad day-to-day operations Tan Choon Kiat, Assistant Manager – Market Operations, EMC Pte Ltd
	End of Programme
Time	Programme Day 3: 20 April 2016
9.30	Registration
9.45 – 11.45	Site Visit to Gardens By The Bay (Marina South) Biomass Co-generation Power Plant
11.45 – 12.00	Bus ride to Hotel
12.00	End of Programme
Time	Programme Day 4: 21 April 2016
8.30 – 9.00	Registration
9.00 – 10.30	National Electricity Market of Singapore: Features and New Developments (Part 1) Serena Ho, Senior Economist, EMC Pte Ltd
10.30 – 11.00	Coffee Break
11.00 – 12.30	National Electricity Market of Singapore: Features and New Developments (Part 2) Serena Ho, Senior Economist, EMC Pte Ltd
12.30 – 2.00	Lunch
2.00 – 3.00	Demand Response Demand Response is a form of electricity demand management which allows consumers to reduce or shift their power usage in exchange for payments during times of peak demand or forced outages of power generation plants. Demand Response helps to stabilize the electricity grid during such abnormal events. Adopting Demand Response reduces the need for new peaking power plants to be constructed which complements the capability of existing conventional generation sources and contributes to a greener environment.

	Dallon Kay, President & CEO, Diamond Energy
3.00 – 3.30	Coffee Break
3.30 – 5.00	Integration of Intermittent Energy sources like solar & wind into the grid Rui Liang, Consultant, DNV GL – Energy Advisory
	End of Programme
Time	Programme Day 5: 22 April 2016
8.30	Regisration
9.00 – 10.00	Final Group Work (Coffee will be available for early start!) Break out session to build on the week's discussion. Work together by country to the following: • What are the key things they have learned during the week? • What could be some of the key in their countries in the future? • How can they apply some of the learnings from the workshop in their country? • Identify priority list for public and private sector action in their country to support privatisation of electricity markets. Facilitator: Yeo Kim Dek, Business Development Manager, SEAS
10.00 – 10.30	Coffee Break
10.30 – 12.00	Presentation by Country Representatives followed by Group Discussion
12.00 – 12.30	Closing Ceremony & Presentation of Certificates (SEAS & ADB)
12.30 – 2.00	Lunch
	End of Programme

Annex 2: Country Representatives

No.	Title	Full Name	Position	Organisation	Country
1	Mr	Karma Penjor Dorji	Chief Engineer	Ministry of Economic Affairs	Bhutan
2	Mr	Sangay Dorji Tshering	Monitoring Engineer	Bhutan Electricity Authority	Bhutan
3	Mr	Pema Wangchen	Analyst Officer	Bhutan Electricity Authority	Bhutan
4	Mr	Teng Saroeun	Manager	Electricity Authority of Cambodia (EAC)	Cambodia
5	Mr	Nong Rithya	Manager	Electricity Authority of Cambodia (EAC)	Cambodia
6	Mr	Ly Channarey	Manager	Electricity Authority of Cambodia (EAC)	Cambodia
7	Mr	Rajeev Sharma	DMD	Nepal Electricity Authority	Nepal
8	Mr	Ram Gopal Shiwakoti	CEO	Chilime Hydropower Company Limited	Nepal
9	Mr	Damodar Bhakta Shrestha	CEO	Trisuli Hydropower Company Limited	Nepal
10	Mr	Ferdinand P. Villareal	Acting Department Manager	National Electification Administration	Philippines
11	Mr	Roderick Naval Padua	Director	National Electification Administration	Philippines
12	Ms	Leila B. Bonifacio	Department Manager	National Electification Administration	Philippines
13	Mr	L G Kariyawasam	DGM(Energy Sales)	Ceylon Electricity Board	Sri Lanka
14	Ms	R A A S Senevirathna	DGM(Energy Marketing)	Ceylon Electricity Board	Sri Lanka
15	Mr	Pham Quang Anh	Electricity market specialist	Electricity Regulatory Authority	Vietnam
16	Mr	Nguyen The Manh	Manager, Market ICT Division	Electricity Regulatory Authority	Vietnam

Annex 3: List of ADB Personnel

No.	Title	Last Name	First Name	Position	Agency/Ministry	Country
1.	Ms.	Tolentino	Ana Maria	Access to Energy Consultant	Sector Advisory Service Division, Sustainable Development and Climate Change Department, ADB	Philippines

Annex 4: List of Resource Speakers

No.	Title	Full Name	Position	Organisation	Country
1	Mr	Christophe Inglin	Managing Director	Energetix Pte Ltd	Singapore
2	Mr	Vijay Sirse	Founder Chairman and CEO	CPvT Energy Asia Pte Ltd	Singapore
3	Mr	Tan Liang Ching	Senior Vice President, Business Development	Energy Market Company Pte Ltd	Singapore
4	Mr	Joel Tai	Business Development Manager	Energy Market Company Pte Ltd	Singapore
5	Mr	Tan Choon Kiat	Assistant Manager, Markets Operations	Energy Market Company Pte Ltd	Singapore
6	Ms	Serena Ho	Senior Economist, Market Administration	Energy Market Company Pte Ltd	Singapore
7	Mr	Dallon Kay	President & CEO	Diamond Energy	Singapore
8	Ms	Rui Liang	Consultant	DNV GL – Energy Advisory	Singapore