



กระทรวงพลังงาน
MINISTRY OF ENERGY

International Conference on Energy 4.0 Designing the Future of Thailand's Power Sector

January 24-25, 2019 | Bangkok

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1. AN OVERVIEW

INTERNATIONAL CONFERENCE ON ENERGY 4.0

The Asian Development Bank (ADB) and the Ministry of Energy of the Kingdom of Thailand jointly organized a two-day international conference in Bangkok during 24-25 January 2019 to deliberate on the future of Thailand's power sector. Drawing on experience and

inputs from a wide range of policy makers, experts, academics, practitioners, leading thinkers and delegates, the two-day conference offered new insights that will influence the design and development of Thailand's power sector.



From left to right: Harald Link, Chairman, B Grimm Power Public Co., Ltd.; Prasert Sinsukprasert, Inspector General, Ministry of Energy, Thailand; Somphote Ahunai, Founder and CEO, Energy Absolute; and Andrew Vesey Former CEO, AGL Energy.

300

PARTICIPANTS

20

COUNTRIES

17

SESSIONS

OVER

3

TRACKS

106

SPEAKERS

The conference was built around a triad of themes related to energy and the future of the electric utility: transport and mobility, scaling up renewable energy, energy efficiency and digitalization. If there was any doubt before the conference about how rapid changes within these three areas were going to be critical to shaping utility business models, the dynamic discussions in the conference provided a clear confirmation that a new future was not just imminent but already rapidly taking shape.

Innovation, clean technologies, declining costs, the need to address climate change, government policies, digital technologies and

community activism on climate are all combining to shape a new energy sector. Conference discussions focused on these themes, covering best practices and experiences from Thailand and internationally, to consider how Thailand's power sector can—and indeed must—evolve to adopt, adapt and grow with these changes.

As a regional leader that sparked the wider deployment of renewable energy across Southeast Asia, Thailand's hosting of the Energy 4.0 conference was an opportunity to reflect on the historic journey of Thailand's energy sector, and the challenges and opportunities that remain ahead.

WHERE TO NEXT, THAILAND?

With 300 participants from 20 different countries where everyone had an opinion, often in two languages (Thai and English) with simultaneous running translation, distilling a

simple answer was never going to be easy. But as the Honorable Minister, Dr. Siri Jirapongphan, said in his remarks, what is clear is that the world is rapidly transitioning to a new era on energy.



From left to right: Pradeep Tharakan, Principal Energy Specialist, ADB; Poonpat Leesombatpiboon, Executive Director, International Energy Cooperation Office, Thailand Ministry of Energy; and Hon. Siri Jirapongphan, Minister of Energy, Thailand.

2. OPENING PLENARY

DISRUPTION. TRANSITION. THE FUTURE.

These were the words most frequently bantered about during the conference. But how should Thailand tap into these disruptions to transition its power sector into the future?

Eminent personalities from the Thai government, Asian Development Bank, Government of Canada and the private sector offered a wide range of public and private sector perspectives on how Thailand's power sector could harness the transformative potential enabled by the intersection of clean energy technologies and the interconnected digital economy.

Policies and regulations must be tuned to enable power systems to harness emerging opportunities and facilitate the transition. This

was a key insight that emerged – a view that was echoed by many of the speakers in the inaugural session and across the entire two days of the conference. Governments have a key role to play in structuring markets, providing policies and regulations that align incentives to take advantage of new technologies, systems and approaches.

A validation of the need for Government leadership in steering the power sector transition was emphatically delivered by the Honourable Siri Jirapongphan, Minister of Energy of the Kingdom of Thailand. Delivering the opening keynote address, the minister announced that just earlier that day, the National Policy Committee had approved Thailand's Power Development Plan (PDP) 2018.



From left to right: Somphote Ahunai, Founder and CEO, Energy Absolute; Ramesh Subramaniam, Director General, Southeast Asia Department, ADB; Harald Link, Chairman, B Grimm Power Public Co., Ltd.; Hon. Siri Jirapongphan, Minister of Energy, Thailand; Donica Pottie, Ambassador of Canada to Thailand, Cambodia and Laos; Andrew Vesey, Former CEO, AGL Energy; Prasart Sinsukprasert, Inspector General, International Affairs Division, Ministry of Energy, Thailand; and Michael Barrow, Director General, Private Sector Operations Department, ADB.



**Poonpat
Leesombatpiboon**

Executive Director,
International Energy Cooperation Office,
Thailand Ministry of Energy, Thailand

“We have to revise our national power development plan to reflect the changing energy landscape and better mitigate the effects of climate change while ensuring reliable power for all.”



Donica Pottie

Ambassador of Canada to
Thailand, Cambodia and Laos

“We are a willing and committed partner of Thailand ... and welcome opportunities to support your efforts to improve your shift into more renewable energy as a bigger part of your power mix.”



Harald Link

Chairman,
B Grimm Power
Public Co., Ltd.

“Be a good ESG company, which is attractive to investors/financial institutions who provide long term reasonably priced funding for future business expansion.”



Michael Barrow

Director General,
Private Sector Operations
Department, ADB

“The journey [on clean energy financing] started for us from here in Thailand. That journey has progressed quite a bit.”



**Ramesh
Subramaniam**

Director General,
Southeast Asia Department,
ADB

“The current infrastructure investment [\$881 billion per year] in the Southeast Asia region is well below the level that is required [\$1.3 trillion per year]. There is a large gap that needs to be met ... and much of that will come from the private sector. ”



Andy Vesey

former Managing
Director and CEO,
AGL Energy Limited

“Transitions are not easy. Everything we are feeling now, this uneasiness, this change [in the energy sector], this is what disruption is.”



Somphote Ahunai

Founder and CEO,
Energy Absolute

“Thailand has to shift its focus from buying technology to creating its own [technology]. I do believe that this approach will be sustainable and contribute to a better Thailand.”

The PDP, he said, is a 20-year road map that will guide the country toward energy security, economic prosperity, and environmental sustainability. The road map will help guide Thailand toward its vision of Energy 4.0, by integrating disruptive energy technologies and systems throughout the power sector. This, he said, would make electricity prices affordable, “in all likelihood cheaper, hopefully much cheaper in the near future.”

As an indication of the Government's leadership toward the new energy vision, the minister announced that Thailand's Eastern Economic Corridor would be transformed into a smart grid region. The share of non-fossil fuels in Thailand's total power output, he added, would increase further to 35% by 2037, including an earmarked 1,000 MW of solar rooftop on residential premises.

The private sector, financial institutions and development partners will collaborate with the Thai government to secure the transition to Energy 4.0. Harald Link, Chairman of B. Grimm Power Public Company Limited and

Somphote Ahunai, Founder and Chief Executive Office (CEO) of Energy Absolute, used their keynote speeches to describe how the private sector is expanding the scope of its energy services to take advantage of new opportunities. This is also enabling them to drive innovation at home, which is a central tenet of Thailand's growth strategy under Thailand 4.0.

Enabling this energy transition requires a wider range of financial solutions and investment instruments. With a strong history of private sector engagement on energy, Thailand, already a leader in the region, could benefit from the blend of technical advisory and financial support that institutions such as Asian Development Bank can offer.

Financial institutions and development partners represented at the conference publicly committed to remaining as trusted partners in Thailand's economic growth, Thailand 4.0, and the related energy transition, Energy 4.0.

“Thailand’s total eastern corridor will be a smart grid power region, the first in the South East Asia region.”

**Honourable
Dr. Siri Jirapongphan**

Minister of Energy
of the Kingdom of Thailand



3. KEY HIGHLIGHTS OF TRACKS

UTILITIES, DIGITALIZATION AND ENERGY EFFICIENCY



From left to right: Wisaruth Maethasith, Professional Engineer, Department of Alternative Energy Development and Efficiency, Ministry of Energy, Thailand; Melanie Slade, Senior Program Manager, International Energy Agency; Archana Walia, Director, India Program, CLASP; Roland Tan Thuan Tee, Senior Manager (Industrial Energy Efficiency Unit), National Environment Agency; and Lin Lu, Senior Operations Coordination Specialist, ADB.

The Energy 4.0 conference featured a track dedicated to exploring how energy efficiency and digitization are reshaping electricity markets, particularly the role and business models of power utilities. Spread over five sessions, the track discussions began with a broad look at technology and market potential, business models and innovation. These sessions were followed by a session spotlighting initiatives on municipal street lighting; a deeper, focused examination of relevant policy and regulations; and discussion of financing approaches.



Eric Woods
Research Director,
Navigant

“It is the marriage between the practical and visionary that is making street lighting such a fascinating discussion.”



Arthur Lam
Co-founder and Vice
Chairman, Synergy Group
Holdings International
Limited

“We are now offering digital transformation as a service [to achieve energy efficiency].”



Jiwan Acharya
Principal Energy Specialist,
ADB

“A key challenge is in demonstrating that borrowing for energy efficiency is more profitable than for other projects.”

Technology and market potential:

Highlighting new technologies and innovations in energy efficiency, this session addressed how digital connectivity is providing big data that is being increasingly combined with analyses and efficient products to enhance productivity and energy savings.

Business models and innovation: Drawing upon international experience, this session described innovative approaches to designing and financing energy efficiency businesses that could be adopted and scaled up in Thailand.

Municipal street lighting – lessons for the field: Drawing from rich practical lessons from around the world, this session discussed design and finance elements for effective municipal street lighting programs.

Policy and regulatory opportunities: This session examined how policies, regulations and institutional arrangements must adapt to shape markets and incentives for energy efficiency in the digitalization data.

Financing energy efficiency: Drawing from a wide range of global experience, this session discussed different approaches and trends on financing of energy efficiency.

TAKEAWAYS

POLICY. DIGITALIZATION. AGGREGATION.

Three big concurrent forces shaping the evolution of energy efficiency are policy, digitalization and aggregation. Governments have a central role to play because supportive policy frameworks are needed to help guide and drive growth. The increase connectivity resulting from digital technologies is shaping how energy efficiency is being implemented. Aggregation, enabled by digital technologies, is offering an unprecedented opportunity to finance and scale energy efficiency projects.

During the sessions, a range of companies from Thailand and abroad discussed a variety of business models that were already tapping rich opportunities around energy efficiency. The ability to use digital technologies for improved optimization of monitoring and performance, for example, is already driving energy savings of 15-20% vs. baseline energy use without the need for any further retrofits. Companies that are combining digital technologies, data analytics and efficiency improvements are offering innovative digital transformation as a service – a business model that offers a peek into how energy services will be provided in the future.

GOVERNMENT LEADERSHIP WILL BE KEY

Government has a key role to play in shaping the ecosystem that will serve as the platform for the emerging opportunities in energy efficiency and the power sector. From shaping policy and regulations and creating markets, to ensuring that incentives are aligned, the centrality of government's role in the evolution of energy markets was stated, restated and repeated yet again many times across all the sessions.



Yanchao (Ethan) Xia

Product Director,
Equota Energy Technology
(Shanghai) Co., Ltd.

“Currently in developing countries, humans plus artificial intelligence is proving to be more useful and efficient.”



Mark Lister

Managing Partner
Asia Clean Energy Partners

“We need to dramatically scale energy efficiency, and we now have the [digital] technologies that we didn't have before.”

**Wisaruth Maethasith**

Professional Engineer,
Department of Alternative
Energy Development and
Efficiency, Ministry of Energy,
Thailand

“Data is very important for policy makers; how do we collect and monitor data? How do we integrate digital technologies into the policy process?”

Lessons from many markets illustrated how large-scale procurement is helping to significantly reduce the cost of energy-efficient technologies. One example highlighted during the sessions was Energy Efficiency Service Limited (EESL), a state-owned super energy services company (aka Super ESCO) in India. As a result of its government ownership, EESL has been able to aggregate demand across projects and take the risk of payment recovery from municipalities and utilities. And of course, utilities also have a key role to play. They are natural aggregators with access to energy customers and the ready digital platforms to tap into these emerging opportunities.

IMMENSE OPPORTUNITIES FOR THAILAND

For Thailand, the opportunities for energy efficiency enabled by digital technologies, new business models and the range of financing instruments is consistent with the national goals of increasing energy efficiency by 30% by 2037. Thailand will seek to design a range of voluntary and compulsory measures to tap into these opportunities, while providing a mix of fiscal incentives with subsidies, soft loans and performance-based monetary support. As it designs its next wave of initiatives on energy efficiency, Thailand will seek to integrate disruptive technologies, particularly around digitalization, power systems control and management. Its goal in the area of the Internet of Things is to move beyond just sensors to more active monitoring, remote monitoring and control.

UTILITIES AND RENEWABLE ENERGY



From left to right: Wei-nee Chen, Chief Corporate Officer, Sustainable Energy Development Authority, Malaysia; Bundit Sapianchai, President and CEO, BCPG; William Derbyshire, Director, ECA UK; Erik Berger, Sales Manager, Asia, Multiconsult; David Martin, Co-founder and Managing Director, Power Ledger; and Ding Junwei, Former CIO, Elion Clean Energy Company Limited.

Spread across five interactive sessions, the track on utilities and renewable energy offered perspectives from public and private sector experts on technological developments, business models, financing and grid integration, with the goal of identifying the catalyst that could help scale up renewable energy deployment.

Technology and market potential: Covering the current status and expected future trends in renewable energy technologies, this session explored how these developments are likely to influence power markets.

Business models and innovation: Highlighting new business models and innovations in distributed energy, this session included discussions on technologies (solar PV rooftop, floating solar PV, storage), linkages with digital technologies (blockchain and peer-to-peer electricity trading), and how the combination of these technologies is opening up a whole new dimension on business models (new utility business models, energy services, virtual power plants).



Bundit Sapianchai
President and CEO,
BCPG

“Consumers are turning into prosumers, and solar costs are lower than the grid.”



David Martin
Chief Executive Officer,
Power Ledger

“Blockchain enables consumers to install PV on their rooftop and offers them an option to monetize their excess energy in the network.”

Grid integration of variable renewable energy: Drawing from international experience of grid integration of intermittent renewable energy, this session examined technical, market structure, policy and regulatory mechanisms that could be used to integrate intermittent renewable energy into the power system.

Opportunities in financing: This session explored financing of renewable energy through use of debt, project finance, green bonds and incentive schemes, while also examining contractual risk factors from equity investments, banking and legal perspectives.

Policy and regulatory opportunities: This session examined Thai policy and regulatory frameworks for renewable energy, along with discussion of relevant international experiences on power sector reforms, tariff structure, incentives, market-based mechanisms and other strategies for scaling up the deployment of renewable energy in a cost-effective manner.

TAKEAWAYS

GOVERNMENT LEADERSHIP

Market growth, both in terms of the deployment and financing of renewable energy, is coming from consistent application of market rules. Government has a clear role to play in establishing the rules and steering the action. In India, for example, government intervention through auctions for solar power helped mature the sector and enabled a steady decline in the levelized cost of electricity (LCOE) from utility-scale solar— from Indian Rupees (INR) 17 / kWh (\$ 0.24 / kWh) in 2010 to approximately INR 3 / kWh (\$ 0.04 / kWh) today.

REALIZING THE COST BENEFITS OF RENEWABLE ENERGY

A key question for Thailand's power sector is how to ensure that renewable energy can be harnessed at low costs. Reverse auctions, for instance, are one policy instrument that many governments have been increasingly adopting to achieve low prices. It also reflects a move towards market-based mechanisms for pricing electricity from renewable energy, rather than more command-and-control measures like feed-in-tariffs. The average prices resulting from wind and solar auctions have dropped considerably due to combination of technology improvements and use of competitive auctions. It should be noted that auctions are effective when there is a critical mass of competition to deliver low prices.

HARNESSING THE VARIETY IN TECHNOLOGIES AND BUSINESS MODELS

A variety of innovative technologies and emerging business models were highlighted at the Energy 4.0 conference. Floating solar, for example, which could be deployed across lakes, water bodies and irrigation canals, represents a strong untapped potential in Southeast Asia. The costs of floating solar



Hannele Holttinen

Principal Scientist,
IEAWIND Task 25 OA,
Recognis, Finland

“Transition towards power systems of the future is all about flexibility and adaption.”



Daniel Wiedmer

Private Sector Operations
Department, ADB

“Green climate bonds are growing rapidly as an asset class. The first certified climate bond issuance by a power company in Thailand was funded by ADB, and ADB also handled the certification process.”



George Garabandic
Principal Consultant,
Energy Advisory, ESS Lead
for APAC and Australia,
DNV GL Singapore Pte. Ltd.

“Distributed energy is here not only to provide energy. It is also tasked for providing capacity.”

have been declining and are currently around \$ 1.13 - \$ 1.14 / Wp, which translates to a LCOE of approximately \$ 10/kWh. The CEO of BCPG Power, for example, reflected on his company's evolution from a generation company to an energy services company. Through its partnership with Power Ledger's block chain digital platform, BCPG has been implementing pilots in Thailand for peer-to-peer energy trading. Such pilots are rapidly eroding the distinction between producer and consumer, and helping to create a new stakeholder in the Thai power market—the Prosumer.

AFFORDABLE, RELIABLE AND STABLE

In Thailand, utilities are seeking to address the challenge of how to manage grid stability and determine who pays for the grid that is required to accept and manage generation from distributed sources of renewable energy. Three models are being actively considered: zero export, net metering and the virtual battery. Among these three models, the virtual battery model seems to be the most promising from the perspective of Thai distribution utility Metropolitan Electricity Authority.

The evolution of Thailand's power sector will center around the ability to deliver electricity that is affordable, reliable and stable, while ensuring that the production of electricity shifts towards a cleaner, more environmentally sustainable pathway. These simultaneous goals can be achieved only through modernization and flexibility. Thai policy makers already widely acknowledge that renewable energy, energy efficiency and the digital economy can provide the basis for the required modernization and flexibility that must now be part of Thailand's power sector.

UTILITIES, MOBILITY AND TRANSPORTATION



From left to right: Gyeong Chul Kim, Former President, Korean Transport Institute; Peter Galli, Vice President - Communications, Nissan Motor Thailand Co.; Akash Passey, Senior Vice President, Volvo Bus Corporation; Akshima Ghate, Principal, Rocky Mountain Institute; Kazuyuki Takada, Director, Planning Division Technology Strategy Center, New Energy and Industrial Technology Development Organization; and Luke Lu, CEO, Zbestpower Co., Ltd.

Spread across four interactive sessions, the track on utilities, mobility and transportation examined how transport technologies, mobility patterns, storage, autonomous vehicles and digital integration was shaping the future vision, policy and financing for transport around the world.

Technology and Market Potential: Beginning with a future vision for transport and mobility that involves the emergence of electric vehicles, battery technology, metro rail and autonomous vehicles, the session discussed the implications for Thailand.

Business Models and Innovations: Focusing specifically on electric buses, this session examined the market potential, opportunities for deployment in rapid transit (BRT) systems and cross-over linkages with solar charging station networks for doubling as grid energy storage.

Last Kilometer Connectivity: This session examined how digital software is shaping use



Yossapong Laonual
President, Electric Vehicle
Association of Thailand

“Thailand hopes to be a hub for electric vehicles in Southeast Asia; to do so it will have to learn from other countries’ experiences.”



Jurg Gruetter
Gruetter Consulting

“If utilities don’t move on EV opportunities, others will.”



Gyeong-Chul Kim
Former President,
Korean Transport Institute

“My father’s generation built 160 flyovers in Korea; my generation is demolishing flyovers for greenways.”



Monrawee Ampolpittayanant
Country Head of Public
Affairs, Regulatory Affairs
and Social Impact,
Grab Thailand

“Studies show only 1.6 million cars can be accommodated in Thailand; we have 5.7 million cars on the road.”



Lloyd Wright
Senior Urban Development,
Specialist (Transport), ADB

“Money never starts the idea; it is the idea that starts the money.”

of electric three-wheelers, electric bicycle and autonomous vehicle in last mile connectivity for getting people from public transit systems to their homes.

Policy and Financing: This session examined linkages between Energy 4.0 and Smart City approaches, highlighting the importance of standards for future electrified transport systems, and their linkages with broader international climate and sustainable development goals (SDGs). The speakers offered a wide range of perspectives on financing of sustainable mobility.

TAKEAWAYS

THREE MOBILITY REVOLUTIONS WITH IMPLICATIONS FOR UTILITIES

Three current revolutions—electrification of fleets, app-based, shared mobility (aka on-demand ride hailing) and autonomous, driverless vehicles—are underway in transport and mobility. All have implications for electric utilities.

With this transition, by 2050, much of the Thai vehicle fleet may be electrified. The question is whether utilities will be a beneficiary of this transformation or whether it will be a lost opportunity. Non-utility players (app-based service providers, vehicle manufacturers, battery suppliers) may take the lead in supplying energy if utilities are not pro-active today.

MOVE PEOPLE, NOT CARS

Congestion and overall mobility will worsen over time if electric vehicles are not accompanied by sustainable mobility policies that favor public transport and non-motorized transport. Merely changing the propulsion system to electric does not improve congestion and may even worsen road safety (as the quiet nature of EV operation means more pedestrians will be injured and killed).

For Thailand, this means the electrification of fleets should first prioritize buses, minibuses, bicycle sharing systems, and tuk-tuk replacements. Transport planning in Thailand should follow the “four zeroes”: zero congestion, zero air pollutants and greenhouse gases, zero traffic crashes and zero private cars in city core.

The priority should be to move people, not cars.



Wei-Shiuen Ng

Analyst and Modeller,
International Transport
Forum

“Sustainable mobility goes beyond electrification: it must be efficient, safe, and inclusive.”



Ingo Puhl

Managing Director,
South Pole Group, Thailand

“Transport policy with a climate target can create opportunity and dialogue.”



Akash Passey
Senior Vice President,
Volvo Bus Corporation

“I will take my grandchildren to the Volvo museum to see a combustion engine as a thing of the past.”

MAKING IT HAPPEN

Lessons presented from Singapore, China, India, US, and Europe showed that the pathway to the three revolutions in mobility can be facilitated by the following:

- Affordability of electric vehicles (ensure tariffs of components do not discourage the market)
- A combination of fiscal and non-fiscal policies and incentives, such as target setting, taxes and strict emission standards
- Smart grid utility policies
- Linking renewables to EV as the generation source
- Prioritizing buses, minibuses, bicycles, and other sustainable fleets
- Making the vehicles attractive to consumers.

4. CLOSING PLENARY

PART 1:

REFLECTIONS FROM THE CONFERENCE AND THAI UTILITY PERSPECTIVES



From left to right: Peter du Pont, Managing Partner, Asia Clean Energy Partners; Melanie Slade, Track Co-Chair, Utilities, Digitalization, and Energy Efficiency; Peerapat Vithayasrichareon, Track Co-Chair, Utilities and Renewable Energy; Lloyd Wright, Track Co-Chair, Utilities, Mobility, and Transportation; Patana Sangsriroujana, Deputy Governor, Electricity Generating Authority of Thailand; Kirapat Jiamset Governor, Metropolitan Electricity Authority; and Saranyphong Atchvunthong, Deputy Governor, Provincial Electricity Authority.

The first part of the closing plenary brought together three key leaders of Thailand's power sector, and was an opportunity to reflect on the implications to Thailand of the rapid energy sector transformations underway globally.

Thailand's utilities are keenly aware of changes sweeping through the world – the confluence of renewable energy, digital technologies, electric mobility, and clean energy technologies that can offer clean, sustainable and affordable energy.

In adopting these changes, however, Thailand will remain mindful of its first generation power systems. The question before Thailand is how to harmonize renewable energy integration and secure an affordable and reliable supply of electricity for the country – this is the opportunity and challenge.



Patana Sangsriroujana
Deputy Governor, Electricity
Generating Authority of Thailand

“We will ask the regulator to set up the rules of the game for rooftop solar, to allow people to be prosumers. The vision is for people who want to use solar energy in their house, to also be able to sell energy back to the grid. This will be an innovative solution for the next generation of electricity in Thailand.”


Kirapat Jiamset

Governor, Metropolitan
Electricity Authority

“For MEA, most renewable energy is solar, and thus intermittent. On the other hand, there will also be more and more electric vehicles (EVs). We can manage our distribution system and better serve the system by integrating EVs along with the solar.”


Saranyphong Atchvsunthon

Deputy Governor,
Provincial Electricity Authority

“To strengthen its distribution network and integrate digitalization into the grid, PEA is actively working to test and deploy smart grids, micro-grids, mini hydro, and solar PV projects in its service area.”

Energy 4.0 will be disruptive. In Thailand's case, the integration of intermittent renewable energy may be the key source of the disruption. On the other hand, there are, for example, opportunities from electric vehicle, which can provide a way to manage the intermittency and distribution system.

The announcement about the official acceptance of the updated PDP was made on the opening session of the conference. This announcement was followed up in this plenary by an insightful discussion on what this means for the energy sector. EGAT has two main responsibilities under the PDP. The first one is to modernize the grid to be able to be an energy hub within ASEAN. The second responsibility is to introduce flexibility to integrate RE (renewable energy) into the grid, to be able to accommodate more and more RE in the future.

Storage is a flagship issue for Thailand as it seeks to integrate its energy sector with the future. Storage holds the promise of an innovative solution. The combination of storage and new energy technologies can deliver on flexibility and modernization.

Thailand must seek to imagine and build innovative solutions in the energy sector in ways that can deliver three simultaneous objectives: affordable, reliable and stable. Thailand is committed to finding solutions for integrating the future into its past and present.

PART 2:

UNLOCKING ENERGY 4.0 FOR THAILAND AND THE REGION



From left to right: Itamar Orlandi, Global Head of Frontier Power and Head of Southeast Asia, Bloomberg New Energy Finance; Andrew Jeffries, Director, Southeast Asia Energy Division, ADB; Csilla Kohalmi-Monfils, EVP Innovation, ENGIE Fab; Peeratarat Ittarattanachoke, Country Manager, Gas Power Systems, GE Power; and Ittiporn Intravisit, First Vice President, Head of Corporate Credit Product Department, Kasikorn Bank.

Drawing on the experiences of prominent speakers from the public and private sectors, the concluding session served as a thought-provoking capstone to already rich discussions of the conference.

The emergence of a wide variety of financing instruments for the evolving energy sector, a key point highlighted throughout the conference, was further reinforced with a discussion of green bonds. More than \$500 billion worth of green bonds are outstanding. The action is now poised to shift to emerging markets, where infrastructure financing could provide the yield that such bonds will need in the future. Significant growth in green bonds is expected across the Association of Southeast Asian Nations (ASEAN) region.

Possibilities in the area of energy, digital technologies and mobility are reshaping how people will choose to live, and the future design of cities. New cities could rise vertically, offering community spaces that replicate squares and open spaces of traditional cities. Smart City 4.0 will revolve around mobility.



Csilla Kohalmi-Monfils
EVP Innovation,
ENGIE Fab

"Asia has shown that in some areas they are the front runner. If you bring that innovation in the energy sector, beautiful things can happen."



Sean Kidney
CEO, Climate Bond
Initiative

“In 2017, we [the world] installed more air conditioning than renewable energy capacity.”



Andrew Jeffries
Director, Southeast Asia
Energy Division, ADB

“In Thailand, relative to other countries, there is an ability to generate longer term local currency debt. ”

As Thailand's power sector now prepares for disruption, and evolution, the country recognizes that it must also carry the past as it moves into the future. It cannot leave behind the 1st generation system entirely, and so must to some extent evolve and harmonize renewable energy and energy efficiency to deliver affordable, reliable and stable electricity for all.

Thailand's latest PDP, which coincidentally was approved on the first day of the conference, places new requirements on the country's utilities to modernize the grid and enhance flexibility to integrate more with future opportunities.

Even as the Thai utilities begin reshaping their strategies, there is widespread recognition across Thailand that rapid technological changes and innovations are creating both significant challenges as well as massive opportunities in the energy sector. Just as Thailand 4.0 seeks to usher Thailand into a new era of growth on an economy of innovation, Energy 4.0 seeks to capitalize on the innovations in the energy sector to usher in a new future for Thailand's power sector.

5. CONFERENCE AT A GLANCE

Day 1—Thursday January 24, 2019			
8:00 - 9:00 a.m.	Morning Coffee and Registration		
	Track 1 Utility, Mobility, and Transportation (Meeting Room 3)	Track 2 Utility, and Renewable Energy (Meeting Room 4)	Track 3 Utility, Digitalization and Energy Efficiency (Meeting Room 1-2)
9:00 - 10:30 a.m.	Session 1.1: Technology and Market Potential for Sustainable Mobility	Session 2.1: Technology and Market Potential for Renewable Energy	Session 3.1: Technology and Market Potential for Digitalization and Energy Efficiency
10:30 - 11:00 a.m.	Morning Coffee and Registration		
11:00 - 12:30 p.m.	Session 1.2: Business Models and Innovations in Sustainable Mobility	Session 2.2: Business Models and Innovations in Renewable Energy	Session 3.2: Business Models and Innovations in Digitalization and Energy Efficiency
12:30 - 2:00 p.m.	Lunch Break		
2:00 - 3:45 p.m.	Inaugural Plenary: The Role of Thailand in Southeast Asia: Preparing for the Transition Toward a Sustainable Power Sector (Meeting Room 1-2)		
3:45 - 4:15 p.m.	Coffee Break		
4:15 - 5:45 p.m.	Session 1.3: Last Kilometer Connectivity	Session 2.3: Grid Integration of Variable Renewable Energy	Session 3.3: Saving Energy and Costs in Municipal Street Lighting: Lessons from the Field
6:00 p.m.	RECEPTION (Sala Thai Room)		

Day 2—Friday January 25, 2019			
9:00 - 10:30 a.m.	Session 1.4: Policies and Financing for Sustainable Mobility	Session 2.4: New Opportunities in Financing Renewable Energy	Session 3.4: Policy and Regulatory Opportunities for Digitization and Energy Efficiency
10:30 - 11:00 a.m.	Coffee Break		
11:00 - 12:30 p.m.		Session 2.5: Policy and Regulatory Issues in Renewable Energy	Session 3.5: Approaches to Financing Digitalization and Energy Efficiency
12:30 - 2:00 p.m.			
2:00 - 3:00 p.m.	Closing Plenary (Part 1): Reflections from the Conference and Thai Utility Perspectives (Meeting Room 1-2)		
3:00 - 3:30 p.m.	Coffee Break		
3:30 - 5:30 p.m.	Closing Plenary (Part 2): Unlocking Energy 4.0 for Thailand and the Region (Meeting Room 1-2)		

LEGEND:

	Plenary Session (Meeting Rooms 1-2)
	Track 1: Utility, Mobility, and Transportation (Meeting Room 3)
	Track 2: Utility and Renewable Energy (Meeting Room 4)
	Track 3: Utility, Digitalization, and Energy Efficiency (Meeting Room 1-2)



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