

IRENA INNOVATION DAY: THAILAND

SUMMARY OF KEY INSIGHTS FROM THE DISCUSSIONS

EVENT OVERVIEW

Building on IRENA's biennial Innovation Weeks, IRENA Innovation Days are taking place in different countries and regions around the world aiming to connect national, regional and international innovators and policy makers to share their experiences and showcase emerging innovations to inspire broader and faster uptake of variable renewable energy to help deliver a renewable-powered future.

3 sessions

27 expert speakers

Over 150
participants

Over 25 countries
including ASEAN

On **4 September 2019**, over 150 delegates from the International Renewable Energy Agency's (IRENA's) member countries gathered in **Bangkok, Thailand** for the **second IRENA Innovation Day**, which was organized jointly with the Ministry of Energy of Thailand. Discussions drew on the experiences of governments and innovative companies across Thailand, the ASEAN region and further afield, as well as on global insights captured in IRENA's 2019 report [Innovation landscape for a renewable-powered future](#).

Despite global trends, regional conditions are important drivers of transformation of the power and end-use sectors. The opportunity to convene discussions by gathering a mix of regional and international experts and policy makers enables understanding of the particularities of the ASEAN region, as well as seeking innovative solutions deployed in different parts of the world through the optics of the region and seek their replicability through the cooperation.

SESSION 1: SOLUTIONS TO DECARBONISE THE ROAD TRANSPORT

Discussions explored complementarities between liquid biofuels (biodiesel and bioethanol) and the direct and indirect electrification of road transport, including the potential role of electric and fuel cells vehicles to decarbonise the road transport. The panel was **moderated by Alexey Kabalinskiy**, the researcher from the Asia Pacific Energy Research Centre, whilst the scene was set by Martina Lyons, IRENA's consultant. The following **panellists** joined the discussion:

- Dr Nuwong Chollacoop, Renewable Energy Team Leader, National Metal and Materials Technology Center (MTEC)
- Bert Fabian, Programme Officer, Air Quality and Mobility Unit Asia Pacific, UNEP
- Luiz Augusto Horta Nogueira, Researcher, Engineer on biofuels, University of Itajuba, Brazil
- Nikola Medimorec, Senior Researcher E-mobility, Partnership on Sustainable, Low Carbon Transport
- Karmin Sridech, Business Area Manager, Advisory & Advanced Analytics, TRACTEBEL ENGINEERING
- Sanin Triyuanond, Chairman, Thai Biodiesel Producer Association
- Alfred Wong, Director, Asia Pacific Sales on Hydrogen Fuel Cells, Ballard Power Systems

Highlights from the discussion:

- » **Cooperation and experience sharing are key to broaden support for deployment of technologies that decarbonise road transport in line with climate objectives.** Transport sector in ASEAN represents 28% of GHG emissions and it is the sector with the lowest level of renewable energy use amounting only to 3%. But it has some of the higher renewable growth potential. To unlock this potential and in turn effectively reduce GHG emissions, cooperation and experience sharing are recognised as apt enablers that support faster and broader uptake of innovative solutions decarbonising road transport.
- » **Decarbonisation of road transport requires seeking complementarities between biofuels and electrification.** Technologies - liquid biofuels (bioethanol and biodiesel), electric and hydrogen fuel cells vehicles – are available in different stages of maturity to transform road transport. ASEAN countries

have both the considerable technical background to enable liquid biofuels production and have started adopting various incentives and policies for electric and hydrogen fuel cells vehicles to gain real market traction. But more needs to be done through policy and fiscal support that would incentivise deployment of different technologies based on their application case. Despite technical capacities and the introduction of targets and incentives, many sought after benefits are being cancelled out by a lack of a more integrated approach that would go beyond technologies and would consider socio-economic implications and systemic approach to innovations.

- » **There is an urgent need for integrated urban transport policies and roadmaps and targeted communication strategies.** ASEAN countries recognize an urgent need to transform their urban transport, which is being characterised by congestion, air and noise pollution, lack of infrastructure, increasing energy consumption as well as high oil dependency. Despite recognizing a pressing issue, progress is stagnating and requires greater ambition and a more integrated approach. It was recognised that in addition to seeking complementarities between different technologies, it is crucial to focus on urban settings (including public transport, walking, cycling, building compact cities to decrease a need for cars), build necessary infrastructure, carefully design mobility as a service while avoiding proliferation of congestion and pollution issues, and go beyond technology and focus on socio-economic implications. It is equally important to communicate policy objectives properly and seek ways to increase awareness and engagement among various stakeholders.
- » **Biofuels are regional low-hanging fruits.** ASEAN countries have a considerable technical background to enable biodiesel and bioethanol production. In addition, biofuels production brings important positive externalities that are often not considered, ranging from the energy security, jobs creation, to income generation and linked social benefits. Its primary utilisation lies in heavy long-distance freight trucks that are unlikely to be fully electrified due to the higher energy density. To expand production and consumption of biofuels and bring stability and predictability for new investments, ASEAN countries have been introducing and increasing biofuels blending targets, e.g. in Indonesia from B20 to B30, for crude palm oil B100, in Malaysia from B10 to B20 and in Thailand from B10 to B20, Philippines E10 and B4 to E20 and B20. In addition, sharing experience with Brazil included production of hydrogen from ethanol as a viable solution in tropical countries.
- » **There is an increasing zest and a need for a more sustainable approach to liquid biofuels in the region.** In an effort to decarbonise transport, sustainability requirements need to be imposed on the way the industry is managed. Governance assistance will play a significant role particularly for small farmers where a sustainable approach to farm management is required. Such measures will include mitigating indirect land use change (ILUC), fertilisers efficiency and other sustainability requirements. In turn, introduction of sustainability may open trade opportunities including to the EU, previously ASEAN's biggest export market.
- » **Electrification of transport only if sufficiently coordinated with a grid planning.** Deployment of electric vehicles (EVs) must be accompanied by building a necessary infrastructure, including charging infrastructure and in particular the smart charging infrastructure. EVs will be only then allowed to play a double role as they will decarbonise a road transport and become a flexibility source for a power sector. Governments across the ASEAN region are very slowly moving towards transport electrification and have introduced subsidies including import duties, tax credits, etc. In addition, countries are paying increased attention and subsidise installation of charging stations. Currently many private buildings have charging stations, but more needs to be done in public spaces. In addition, governments are learning from experiences around the world on an enabling market design to enable smart charging.
- » **Green hydrogen fuel cells vehicles are being explored as a feasible solution.** Whilst these vehicles exist, their uptake is still relatively small. Regional players are exploring the right application use and are increasingly seeing advantages in utilisation for heavy-duty vehicles. There are several challenges,

technical and otherwise, that must be overcome before hydrogen fuel cells vehicles will be a successful, competitive alternative for consumers. Given an ultra-competitive market of vehicles, hydrogen fuel cells vehicles will have to offer consumers a viable alternative, especially in terms of performance, durability, costs and available refuelling infrastructure. In addition, enabling roadmaps lead and help industry with investment decisions as observed in other regions (US, EU, China, Japan, Korea), and are urgently needed in ASEAN.

SESSION 2: DIGITAL SOLUTIONS FOR RENEWABLE POWER

Discussions explored digitalization-enabled business models for managing demand and supply and providing flexibility to the system – for example blockchain, artificial intelligence or internet of things enabled solutions such as distributed generation or flexible and smart grids. The session was **moderated by Alastair Marke**, the Director General of the UK Blockchain and Climate Institute. The session included three presentations and was followed by the panel discussion.

Presentation 1: Power Ledger – Energy, reimagined.

Maria Atkinson (Senior Strategic Advisor from Power Ledger) talked how markets booming with distributed energy resources (DERs) coupled with blockchain technologies helped to revolutionize the power balance between consumers and traditional power generation and impacted energy retailers in Asia Pacific region. Digital technologies, including blockchain, enable to preserve value of existing network assets and reduce risk of investment. Blockchain replaces 3rd parties and intermediaries and enables consumers to realise the value of their investments by monetizing their excess energy. By bringing profits back to communities, it incentivises further investments in renewables. For example, in Bangkok, it has enabled a peer-to-peer solar energy trading of the energy excess among large energy consumers (schools, a dental hospital, apartments building and a shopping mall). The area generates on average 2.7 MWh of solar energy daily and trades on average 13 MWh monthly. This has brought consumers approximately AUD \$ 2.200. As a consequence, around 11% of consumed energy within the area is from renewable sources.

Presentation 2: Digital solutions for reducing energy intensity

Adis Peukpattanaruks (Managing Director and Country GM, Johnson Controls, TCLMV) talked about how creating intelligent buildings, efficient energy solutions and integrated infrastructure work seamlessly together to deliver on the promise of smart cities and communities. Johnson Controls design systems enabled by digital technologies – Internet of Things and Big Data - that connect HVAC, lighting, security and protection systems and enables them to communicate on a single platform to deliver consumers information, so they make smarter, savvier decisions. But to do so, Mr Peukpattanaruks emphasized there are more ingredients needed for a success, and digital technologies are only one. It equally needs to be complemented by regulations, corporate policies and commitments, whilst having available right tools and right partners to take an action.

Presentation 3: Reactive Technologies – GridMetrix and Inertia

Peter Bird (Member of the Advisory Board of the Reactive Technologies) talked about changing inertia of the power system due to increased non-synchronous generation (represented by variable renewables) connected to the grid with synchronous generation (conventional). With retiring synchronous generation, and increased variable renewables, inertia fall, which makes it harder to control system's frequency. Low inertia grids are manageable but come with increased costs to consumers. Reactive Technologies developed a digital product that enables to send modulated load signals through electricity grids and by separating the resultant signal from the noise, it monitors the impact on frequency. This improves system operation with improved real-time inertia monitoring so that system operators can manage the system closer to the edge of the inertia, whilst also optimizing operation and ancillary service procurement. For example, monitoring inertia at the UK National Grid ESO saved the UK economy GBP 14.4 million in a year.

The following **panellists** join the discussion:

- Hazril Izan Bahari, Digital Services Director, Malaysia Sustainable Energy Development Authority
- I-Chun Hsiao, Manager New Business Development, Asia Pacific, ENEL X Japan
- Mario Pavlovic, Origin Product Owner, Energy Web Foundation
- Tawatchai Sumranwanich, Director, Generation and Transmission System Planning Division Electricity Generating Authority of Thailand (EGAT)
- Brianna Welsh, Vice President Asia, Sindicatum Blockchain Technologies

Highlights from the discussions:

- » **To maximise their effectiveness, digital technologies need to be implemented together as they support the system in different ways.** With decentralized systems, it becomes challenging to maintain grid reliability and stability, which requires system operators to measure, forecast and trade electricity in a different way.
 - **Internet of Things** and **Artificial Intelligence** allow more data to be collected and intelligently analysed, which in turn yields meaningful results and enables systems to operate more efficiently. Seeing the benefits, Thailand made digital technologies a priority during their 2019 ASEAN chairmanship, particularly Artificial Intelligence in demand side management to empower distributed system operators and customers.
 - **Blockchain** enables transactions between parties without intermediaries in a low-cost way, maintains privacy and security of data and transactions, and allows for a greater transparency. Its current contribution is mostly in the field of traceability and peer-to-peer trading. Its disruptive potential is however only in the beginning to be fully understood.
- » **To enable broader support for blockchain it is important to raise awareness about its benefits and dispel any misconceptions.** The following misconceptions are hampering progress in deploying blockchain in different applications across energy sector:
 - Blockchain is linked to bitcoin. This instills fear of volatility that comes with the reputation of bitcoin. It is therefore important to decouple blockchain and bitcoin.
 - Blockchain is associated with large energy consumption. It is true bitcoin consumes 64 TWh per year which to put into perspective amounts to 1/3 of REN100 top companies' entire annual energy consumption. However, organisations and companies (incl. Energy Web Foundation) use different types of consensus protocols (i.e. proof of authority) that tackle this issue.
 - Blockchain is panacea to all problems. It is important to manage expectations and explain that blockchain does not guarantee the information is accurate, it only helps to secure the data entered. If grid is messy, blockchain will not solve that.
 - Blockchain is hard to understand to be used. It is not inevitable to understand of the workings behind blockchain to be able to use it. Like we do not understand all the workings behind internet and emails.
- » **Artificial Intelligence used in conventional plants allows higher integration of variable renewables into the power system.** To support variable renewables integration, conventional power will be forced to cycle more often. This will incur additional component stress and maintenance costs. Asset health will be critical to ensure these power plants are available for ramping up and down whenever needed. Artificial Intelligence can help to prevent conventional assets' failure and in turn allow higher integration of variable renewables into the power system.
- » **Systemic approach to innovations is key to reap benefits.** Digital technologies must be implemented together with innovative business models and enabling market design to harness benefits, and then further enabled through careful planning and smart policy-making. There are plentiful benefits from adopting digital technologies, but in isolation they are holding benefits back. While business models such as time of use (ToU) tariffs are designed to incentivise consumers to shift their consumption or

invest in storage solutions, without enabling market design, ToU tariffs coupled with digital technologies proved not to be sufficiently attractive. For example, in addition to ToU tariffs enabled by digital technologies, Japanese government has introduced balancing market products through the combination of various value streams to make a business case for both companies and customers to participate in the markets.

- » **Aggregation enabled by digitalisation unlocks potential of individual DERs to provide grid services.** Aggregators capture flexibility from many small-size DERs in a digital way and enable them to act as a single predictable entity, which in turn help to create revenue streams of DERs owners.
- » **Digital technologies increase bankability of projects.** Digital technologies are becoming a key pillar to most financial applications by reducing costs, boosting safety or addressing risks. One of the underlying arguments are that digital technologies enable vast amount of data to be explored, collected, analysed and managed without tampering, which increases their reliability and investors' and policy makers' trust.
- » **Next revolution in blockchain may be coupled with cryptocurrency.** When trading electricity peer to peer, one of the issues is currency. For example, in Latin America, currency is unstable, which increases the risks associated with renewable electricity trading, which in turn makes Latin America rely on digital currency. The use of digital currency in Thailand and other ASEAN countries is however not allowed.

SESSION 3: SOLUTIONS FOR ENERGY STORAGE

Discussion explored the innovative use and integration of large- and small-scale energy storage solutions e.g. flexible-hydro, utility scale and behind the meter batteries and other energy storage options. The session was **moderated by Mark A Hutchinson**, VP and Head of Power and Renewable Consulting, APAC Wood Mackenzie, whilst scene was set by Martina Lyons, IRENA's consultant.

The following **panellists** joined the discussion:

- Kansui Aoki, Representative, CHAdEMO ASEAN Branch, General Manager, Environment and Safety Engineering Department, Nissan Motor Asia Pacific Co., Ltd
- Corentin Baschet, Head of Market Analysis, Clean Horizon
- Ron Benioff, Laboratory Program Manager, U.S. National Renewable Energy Laboratory (NREL)
- Dr. Pimpa Limthongkul, Principal Researcher and Electrochemical Materials and System Research Team Leader, National Metal and Materials Technology Center (MTEC)
- Bjoern Peitzmeyer, Head of Group Finance, Enapter
- Achal Sondhi, APAC Market Director, FLUENCE – A Siemens and AES Company
- Dr. Somphop Asadamongkol, Engineer level 8, Electricity Generating Authority of Thailand (EGAT)

Highlights from the discussions:

- » **Systemic approach central to a broad deployment of energy storage.** There is a diversity of potential applications for energy storage solutions. It is important that the right technology, business models, system operation and market design are all tailored to the application, including peak shaving, seasonal storage, spinning reserves or ramping. In this context, several demonstration energy storage projects are being deployed across Thailand by EGAT and MTEC to understand and observe different energy storage technologies and their benefits for the grid and design an enabling market that would allow their broader utilization.
- » **Energy storage in vertically integrated markets needs to be rightly valued.** In vertically integrated markets, construction and operation of storage for grid support is more straightforward but revenues are not that obvious and require analyzing benefits of investment deferrals, security supply and other ancillary services. Therefore, a fully integrated view on financial benefits of storage system is needed. Yet, such a value determination is challenging and requires computing dispatch of reserves as the first place where storage replaces spinning reserves and liberates some capacity.

- » **Setting ambitious targets is both urgent and essential for incentivising broader uptake of energy storage.** It is important for policy makers to see and understand what storage can do, what flexibility service does it offer and what CAPEX deferral it can provide and following that they should set ambitious targets to send signals to the market (private players and utilities) that storage is no longer considered just a technology innovation, but a crucial asset on the grid, which in turn incentivise players to develop business cases and design enabling markets.
- » **Safety standards should be viewed as part of a hierarchy of requirements for energy storage.** While energy storage provides countless benefits and applications, they do not come without risks, such as risk of fire, as was a case in Korea. Ambitious targets set by policy makers to encourage deployment of energy storage technologies must come hand in hand with safety standards not only for the final product design but also for the installation, service and various other steps along the supply chain. This will require manufacturers, system integrators, designers and installers to develop additional skills.
- » **Seasonal storage applications mostly in remote off-grid areas.** Business case for hydrogen applications is seen mostly in off-grid areas. In remote areas of French Alps, hydrogen allows seasonal storage during winter months, when solar panels are oftentimes covered by snow and do not generate enough power. In Thailand, the Phi Suea House has been in operation since 2015 as a 24-hour solar powered residential development using hybrid hydrogen-battery system. Following these successes, a new project Green Mini-Grid Sandbox will focus on broader deployment of solar-hydrogen solutions in Thailand and the ASEAN region. In the interconnected systems, however, deployment of seasonal storage is justified only with very high shares of variable renewables.

CONCLUSIONS

The ASEAN region is on a remarkable journey of sustained economic growth and enormous technological progress. It has a long track record involving a wide range of technologies from large hydro, biofuels and geothermal, and declining costs of solar and wind have prompted additional gigawatts of installed capacity. Despite that, countries in the region still face challenges to provide modern energy services to all, maintain stability of their grids, build a good transformation system and develop liveable cities. Discussions emphasized that while some of these challenges are technological, many reflect a need for ambitious policies and targets, enabling regulations including sustainability and safety requirements, available finances for projects of different sizes, as well as public awareness, engagement and empowerment.

To respond to these trends and challenges, the region's diverse economies have concentrated considerable efforts to provide supporting environment for **digital technologies** to take off. This is applicable also to the energy sector, which is penetrated with various applications of distributed ledger, artificial intelligence or internet of things, that create business and employment opportunities, increase bankability of projects, help to stabilize and decarbonise the grid and offer flexibility to the grid from the demand-side. Still more needs to be done, including communication to emphasize benefits and dispel many misconceptions among public, while leveraging the impact of these digital technologies by developing enabling market design and business models.

The region's pressing need to tackle air pollution in the cities was stressed in the discussions. Given the region's considerable **technical background in biofuels production and some emerging incentives and policies for electric and hydrogen fuel cells vehicles to gain real market traction**, it was repeatedly stressed that seeking complementarities between these technologies must come hand-in-hand with integrated urban policies and roadmaps that include grid planning and sustainable requirements to avoid proliferation of the issues.

To realise the ambition to integrate higher shares of renewable energy, countries are exploring different **storage technologies** across the region **in both on and off-grid applications**, assessing their benefits, and exploring what else needs to be done to reap their further benefits. Discussions emphasized a necessity for

storage to be valued fully, a call on policy makers to set ambitious targets while introducing safety standards into the regulation.

Discussions stressed the importance of experience sharing and cooperation, and welcomed the organisation of the Innovation Day to gather policy makers and innovators, discuss common and individual challenges, share insights and explore partnerships and collaborations between local and international stakeholders to broaden support for deployment of innovations and innovative solutions to allow higher integration of renewable energy in the power and end-use sectors and enable consumers' engagement and empowerment.