DRILLING & EXPLORATION WORLD

DEW

THE COMPLETE ENERGY JOURNAL

IN PUBLICATION SINCE 1989

INTERNATIONAL EDITION

Volume 26 Number 01

ISSN - 0971 - 7242

dewjournal.com

November 2016

DEW-MEDIA PARTNER-SIEW 2016

SIEW 2016

NEW ENERGY REALITIES

Singapore International Energy Week 2016 (SIEW 2016) brought together representatives of the energy industry, Governments and non-government organisations from across the Asia-Pacific region and from around the world to deliberate on the new energy realities, the future of energy supply, access to reliable energy to minimize carbon footprint

(Page 22)

OPENPATH SEQUENCE
An innovative diversion stimulation service

OpenPath Sequence maximize wellbore coverage to increase production in conventional and unconventional reservoir completions

Propagating cleaner energy ideas, the innovative way

PAGE 90

The first in the industry to use degradable fibers to suspend multimodal particles that enable sequential stimulation of intervals in acid stimulations (Page 18)

DEW - Media Partner

An overview report of SIEW 2016:

Considerable changes in the

Singapore International Energy Week 2016 (SIEW 2016) hosted world's leading energy institutions, industry platforms, top policy makers, professionals, industry players and energy practitioners to discuss new energy realities and how working together can navigate the period of change created by significant shifts in the global energy landscape. The theme of SIEW 2016 "New Energy Realities" was important as the Paris Agreement for climate change has come into force from November 4, 2016 which reiterates a key transition into a new energy future and minimising carbon footprint.

SIEW 2016 organised by the Singapore Energy Market Authority (EMA), a statutory board under the aegis of the Ministry of Trade and Industry, Singapore discussed energy challenges, opportunities, best practices and solutions in Asia-Pacific and elsewhere. SIEW brought together a robust line-up of world's leading conferences, exhibitions, roundtables and networking events to offer insights and perspectives on the emerging trends and innovations across the energy spectrum of oil & gas, clean and renewable energy and energy infrastructure financing – in one week and at one place-Singapore. A report by DEW Journal:

"SIEW 2016 addressed five key areas – Asia's new energy realities; the outlook of oil and gas; building a low-carbon future; how innovative technology is changing the utility landscape; and bridging the energy infrastructure financing gap"

Mr S Iswaran, Minister Trade and Industry, Singapore delievering the opening remarks at SIEW 2016

For one week Singapore International Energy Week 2016 (SIEW 2016) convened those who matter to the energy industry at one place. SIEW has called attention to the challenges posed and opportunities created by significant shifts in the global energy landscape

energy mix, the new energy reality

The wide range of oil & gas and energy issues discussed during the various events in the week long SIEW 2016

The ninth Singapore International Energy Week (SIEW) has called attention to the challenges posed and opportunities created by significant shifts in the global energy landscape. Organised annually by the Singapore Energy Market Authority (EMA), a statutory board formed in 2001 under the aegis of the Ministry of Trade and Industry, Singapore, the event themed "New Energy Realities" hosted world's leading energy institutions, industry platforms, top policy makers, professionals, industry players and energy practitioners to discuss and share best practices and solutions within the global energy space, exchange views and forge closer ties.

For one week from October 24, SIEW 2016 in Singapore convened those who matter to the energy industry at one place.

The theme of SIEW 2016 was important as a result of supply overhanging in oil and gas keeping energy prices down for a longer period than most had expected. This has discouraged new upstream investments, which will impact future supply. At the same time, the Paris Agreement following COP21 has given new impetus to renewables. Innovative technology has also continued to make energy production, systems and networks smarter, heralding new possibilities.

The appetite for economic development and urban progress coupled with

SIEW facilitated the strategic goals of Singapore's commitment to becoming a global leading energy hub and "living lab"

climate change concerns and development of more efficient energy technologies is driving change among consumers and energy industries. SIEW hence facilitated the exchange of ideas through discussions, debates and expert talks on pertinent energy-related issues, while simultaneously meeting the strategic goals of Singapore's commitment to becoming a global leading energy hub and "living lab".

The energy week has grown over the years since Singapore is emerging as Asia's leading energy platform. The Singapore Energy Market Authority (EMA) is tasked to promote effective competition in the energy market, ensure a reliable and secure energy supply, and develop a dynamic energy sector in the country and seek to forge a progressive energy landscape for sustained growth through mutual cooperation.

This year the event addressed five key areas – Asia's new energy realities; the outlook of oil and gas; building a low-carbon future; how innovative technology is changing the utility landscape; and bridging the energy infrastructure financing gap. During the week of SIEW, leaders and experts from around the world debated developments across Asia and generated solutions to forge a substantive energy future.

Having partnered with Asian Downstream Week, Asian Energy Financial and Investment Conference, Asia Clean Energy Summit, and Gas Asia Summit, SIEW with its flagship event Singapore Energy Summit explored fresh viewpoints, insights and perspectives on the energy future besides providing an opportunity to engage with the world's leading energy institutions; industry platforms, experts and industry chieftons. Each of the events during SIEW were meticulously researched and took up issues and challenges looming large over the industry. This allowed them to delve into areas most relevant to the industry.

The energy week besides hosting the Singapore Energy Summit and other Conferences saw the

A section of the dignitaries that addressed Singapore Energy Summit and Energy Access Forum during Singapore International Energy Week 2016 (SIEW 2016)

Opening remarks by Mr S Iswaran, Minister for Trade & Industry, Singapore at SIEW 2016

An oversupplied oil and gas market, slowing demand and weak global economic outlook have kept energy prices lower for longer than many had expected.

Global oil demand growth continues to be slow, reaching a four-year low in the third quarter of 2016, although there are some preliminary signs of recovery. The International Energy Agency (IEA) expects global oil demand growth to be 1.2 million barrels per day this year, with similar growth expected for 2017. Nonetheless, it is uncertain when the global oil market will re-establish a sustainable equilibrium. The outlook for gas is even more muted, with the excess supply expected to continue for some time. Wood Mackenzie estimates that the global gas market could be left

inaugural "Energy Access Forum" focusing powering development in the Asia Pacific. Also featured during SIEW was the Youth SIEW and more than 200 exhibitors across all the events.

SIEW think-tank Roundtables delved into key energy issues, ranging from Asian LNG developments, cyber-security to oil and renewable.

Distinguished panelists during the Asia's New Energy Realities session at SIEW 2016

SIEW Energy Insights featured key energy reports launch. The occasion saw International Energy Agency (IEA) release its Medium Term Renewable Energy Market Report while the World Nuclear Association (WNA) released its report - World Nuclear Performance.

ENERGY SUMMIT AND ENERGY ACCESS FORUM

Adding to the discussions this year along with Singapore Energy Summit was the inaugural "Energy Access Forum – Powering Development in the Asia-Pacific", co-organised by EMA and UNESCAP (United Nations Economic and Social Commission for Asia and the Pacific). The forum built on the outcome of the G20 Energy Ministerial Meeting in Beijing earlier this year brought together stakeholders to share experience and best practices, as well as create business opportunities to support the region's efforts to enhance energy access.

The Energy Access Forum was a one-day event

Experts ponder on 'New Energy Realities'

with 70 million tons in uncontracted supply by 2021.

These projections could affect future global energy supply as producers cut spending and curtail project investments. The IEA estimates that investments in oil and gas have fallen by an unprecedented 25% in 2015.

At the same time, the Paris Agreement has given new impetus for the development of greener energy systems, as awareness of the need to do more to mitigate greenhouse gas emissions grows. The declining cost of renewables has also encouraged investments in clean energy. According to Bloomberg New Energy Finance's New Energy Outlook Report for 2016, renewables will attract US$7.8 trillion in investments between 2016 and 2040, compared to US$2.1 trillion for fossil fuels.

The above were some of the issues flagged by Singapore's Trade and Industry Minister, Mr. S. Iswaran while opening the Singapore International Energy Week 2016 (SIEW) on October 24, 2016.

Advances in technology are also having a discernible impact on energy systems and networks. The increasing deployment of smart energy infrastructure and distributed generation is altering the traditional roles of consumers and grid operators, and the way we generate, distribute and use energy. Consumers are now more empowered than ever to generate their own electricity, optimise their energy use, and respond to market conditions, he stressed.

In the face of these "New Energy Realities", policy makers, regulators and market players alike need to prepare themselves well, to ride on the new wave of opportunities while addressing the challenges ahead, so as to build a more sustainable global energy system, the Minister stressed.

Improving technology for utilities in a smarter nation

In addition to enhanced competition, we want to use technological advances, such as the Internet-of-Things and data science, to develop a smart energy sector that is resilient, innovative and sustainable. To this end, Singapore is making a push towards the vision of a "Smart Nation" to harness the power of networks and data to improve lives and create economic opportunity, he said.

In that regard, we are studying the wider deployment of advanced meters across all our

"An oversupplied oil and gas market, slowing demand and weak global economic outlook have kept energy prices lower for longer than many had expected"

Mr S Iswaran, Minister for Trade and Industry, Singapore address at the inaugural Energy Access Forum

Affordable, sustainable and reliable energy access a critical challenge for Asia- Pacific

"New energy realities are characterised by lower energy prices for longer, new impetus for the development of greener energy systems and key advances in technology in energy systems and network"

This Forum marks the first time that Singapore is collaborating with the United Nations Economic and Social Commission for Asia and the Pacific, UNESCAP, on energy access. UNESCAP plays an important role in the region by supporting countries in their efforts to address energy poverty through capacity-building workshops and conferences. UNESCAP also contributes actively to energy access discussions at the G20 Energy Ministers Meeting.

Energy Access – Powering Development in the Asia Pacific

Ensuring affordable, sustainable and reliable energy access remains a critical challenge for countries in the Asia- Pacific region. While some progress has been made, more can and must be done. Around 455 million people in the region still do not have access to electricity, 130 million of whom are within Southeast Asia. In addition, more than 2.7 billion people worldwide, or nearly 40 per cent of the world's population, do not have access to clean cooking facilities. Furthermore, Asia is urbanising rapidly. It is expected that by 2030, 55% of Asia's population will be living in urban areas. This will also drive demand for urban energy solutions that are clean and smart.

Access to reliable energy services underpins development, growth and ultimately a better quality of life. To ensure that the region is able to fulfill Asia's economic potential, and promise to its people, the need for secure and reliable energy access has to be addressed in a comprehensive manner.

Singapore as a regional financial hub for long-term bankable energy projects

One area of focus is the development of energy infrastructure projects that can catalyse private sector funding. This will help to ensure the sustainability of energy access solutions for the long term.

The development of bankable projects and the mobilisation of private sector funding are issues that have been raised during the industry consultations and discussions of Singapore's Committee on that focused on the challenge of enhancing energy access in the Asia-Pacific region and potential opportunities for collaboration among the countries and international organisations. It featured discussions on enabling policies, technological advancements and creative business models on energy access.

With session topics like Energy Access – Challenges and Opportunities; Energy Access in ASEAN; Energy Access in Focus – Technology and Investments and Unlocking Options - Global Collaboration on Energy Access every minute aspect of the energy

In the face of 'New Energy Realities', policy makers, regulators and market players alike need to prepare themselves well, to ride on the new wave of opportunities while addressing the challenges ahead, so as to build a more sustainable global energy system: Minister Iswaran

utilities. EMA is partnering the national water agency.

Encouraging demand-side management in Singapore

Another opportunity created by technological advances and

industry delved on. Addressed by eminent personalities these sessions saw active participation of Mr S Iswaran, Minister Trade and Industry (Industry), Singapore; Ms.Rachel Kyte, CEO and Special Representative of the UN Secretary-General, Sustainable Energy for All (SE4All); Dr (Ms.) Shamshad Akhtar, Under-Secretary-General of the United Nations and Executive, Secretary of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP); Datuk Seri Panglima Dr Maximus Johnity Ongkili, Minister of Energy, Green Technology and Water, Malaysia; Mr. Simon Bridges, Minister of Energy and Resources, New Zealand; Dr Fatih Birol, Executive Director, International Energy Agency (IEA); Mr. Gireesh B. Pradhan, Chairperson, Central Electricity Regulatory Commission (CERC), India; Mr. Wong Kim

Session on Disruptive Technologies and the Energy Consumer

Session on Energy Financing - Bridging the Gap

smarter energy systems is in demand-side management. It allows consumers to actively manage their energy consumption in response to market conditions, thereby optimising their electricity bills. The power system also benefits from greater efficiency as electricity demand peaks are smoothened.

Hence, EMA will be taking the lead to facilitate demand-side management initiatives. Singapore has launched Project OptiWatt, a pilot programme on demand-side management, where EMA will work with 16 partners to explore initiatives to optimise energy consumption. These partners collectively straddle the energy value chain comprising Institutes of Higher Learning (IHLs), government agencies, private companies, electricity retailers, research institutions and the electricity grid operator. An MOU will be signed today to officially mark the commencement of this partnership.

Our IHLs and government agencies will explore adjusting their consumption patterns without affecting existing operations. For example, electricity retailer Red Dot Power pays participating consumers to voluntarily reduce electricity consumption in certain pre-identified periods. A trial with Nanyang Polytechnic demonstrated that its chillers – amounting to about 7% of the Polytechnic's energy consumption – can be curtailed for half an hour with minimal impact to users within the premises, Mr. Iswaran said.

EMA will also work with companies and electricity retailers on technologies and business models for the Interruptible Load and Demand Response programmes, which are part of the broader demand-side management initiatives, he said.

We hope that these pilots will demonstrate the benefits of demand-side management, and catalyse new business models, technological innovation and consumer engagement so that such initiatives will be more widely accepted.

Release of consultation paper on the policy framework for Energy Storage Systems

To keep pace with the growing share of solar in Singapore's electricity generation mix, we are taking proactive steps to address the issue of intermittency and to ensure grid stability. Energy storage systems offer one solution, particularly with advances in technology and reductions in cost, Mr. Iswaran emphasised.

In addition to enhanced competition, technological advances, such as the Internet-of-Things and data science need to develop a smart energy sector that is resilient, innovative and sustainable needed: Minister Iswaran

the Future Economy. Some of those who have participated in our discussions said that Singapore can play a constructive role in this area, and we agree. The power sector in the Asia Pacific region will require a significant increase in generation capacity and grid infrastructure. In fact, the region is expected to account for over 40 per cent of cumulative energy investments until 2040, according to UNESCAP. This amounts to more than US$25 trillion. The need and opportunity are therefore clear and present. The question is how we can help to organise more bankable energy infrastructure projects in the region and profile them to investors.

Our aim is for Singapore to serve as a collaborative platform where energy infrastructure developers, consultants, governments, financial institutions – including Multilateral Development Banks – and institutional investors come together in a vibrant and multi-faceted ecosystem. Working together, we will be able to activate and mobilise the essential expertise, capital, and insights, to help meet the energy needs of the region.

As a regional financial hub, Singapore is already home to a strong network of well-established financial institutions, both local and international, including the World Bank and the International Finance Corporation. IE Singapore has also worked with the Asian Development Bank on the Asia Infrastructure Centre of Excellence, which helps to create bankable infrastructure projects in the region. Singapore has a good base of professionals who understand Asia, in areas such as law, commercial transactions and engineering consultancy, and whose expertise is needed to structure, and develop these infrastructure projects.

International cooperation key to unlocking energy access options

Given the global nature of the energy access challenge, it is also important for us to continue to enhance international cooperation, and ensure that the public and private sectors share their experiences and create awareness on the options available to increase energy access.

Energy access was a key issue discussed at the G20 Energy Ministers Meeting in June this year. Action plans have been adopted by the G20 Energy Ministers focusing on Sub-Saharan Africa and the Asia Pacific region. These provide options for countries to adopt policies and strategies according to their national circumstances. Singapore is supportive of the G20's initiative to focus on energy access, and its leading role in facilitating international cooperation to address this global challenge.

International cooperation is critical to promote innovative technological solutions, develop sustainable business models and increase access to financing and investments.

Energy access is a shared challenge that we urgently need to address. This Forum is timely, and through it we hope to identify not only the challenges, but also the opportunities and innovative solutions to address them.

Yin, Group Chief Executive Officer, Singapore Power Ltd.; Dr Ith Praing, Secretary of State, Ministry of Mines and Energy, Cambodia; Mr. Peter du Pont, Senior Climate Change Advisor, USAID Asia; Mr.Hiroyuki Hayashi, Senior Advisor to the Director General (Energy), Industrial Development and Public Policy Department, JICA; Mr.Didar Islam, Founder, Solaric Global; Mr. David Hutagalung, Country Director, GE Power Indonesia; Dr Sanjayan Velautham, Executive Director, ASEAN Centre for Energy (ACE); Mr.Jan Flachet, CEO, ENGIE Asia - Pacific; Dr Matthew Peloso, Founder and CEO, Sun Electric; Mr. Allard Nooy, CEO, InfraCo Asia; Mr.Arun Sen, CEO, Coromandel Advisors; Mr.Mark Gainsborough, Executive Vice President, New Energies Shell; Mr. Gordon Lawson, Partner, Head of Energy Sector, KPMG; Mr.Pål Rasmussen, Secretary General, International Gas Union; Dr Sun Xiansheng, Secretary-General, International Energy Forum (IEF); Mr.Sakari Oksanen,Deputy Director-General, International Renewable Energy Agency (IRENA); Liu Hongpeng, Chief, Energy Section, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and Mr. Tony Wood, Energy Program Director, Grattan Institute to name a few.

Key points discussed during the plenary session on Energy Access – Challenges and Opportunities were: Overview of the current state of global energy access; SDG 7: Ensuring universal access to affordable electricity; Insights on key challenges faced by Asia-Pacific countries and opportunities for collaboration; The role of inter

governmental bodies (G20, APEC etc.) and international organisations.

The panel on energy access in ASEAN discussed: US-ASEAN Energy Connect initiative; Energy access situation in ASEAN; The role of regional integration in enhancing energy access; the role of capacity building and technical assistance.

The panel on energy access in focus – technology and investment touched upon: developing business models and financial instruments to support energy access investments; fostering an enabling policy environment for public-private partnerships; development of new technologies and innovations to improve access to electricity and clean cooking, especially in remote areas.

Talking to DEW, Mr S. Iswaran stressed, "Energy access is a shared challenge that we urgently need to discuss. We need to find not only the challenges, but also the opportunities and creative solutions to address them".

He added new energy realities are characterised by lower energy prices for longer, new impetus for the development of greener energy systems and key advances in technology in energy systems and network.

"Policy makers, regulators and market players alike need to prepare themselves well to ride on the new wave of opportunities while addressing the challenges ahead, to build a more sustainable global energy system," he pointed out.

Collaboration will continue to play a key role – both on the industry and international level, Mr.Iswaran said. Ensuring affordable, sustainable and reliable energy access remains a critical challenge for the Asia-Pacific region, he said.

The Energy Access Forum marks the first collaborative effort with the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).

Minister Mr. Iswaran shared although some progress has been made; more can be done, as around 455 million people in the region still do not have access to electricity. Of these, 130 million are in Southeast Asia.

Asia he said, must also address the rising demand for smart and clean urban energy solutions, resulting from its rapid urbanisation. "To ensure that the region is able to fulfil Asia's potential economic potential and promise to its people, the need for

Mr. Ng Wai Choong, Chief Executive, Energy Market Authourity (EMA), Singapore.

Our goal are to enhance a reliable and secure energy supply, promote effective competition in the energy market and develop a dynamic energy sector in Singapore: Ng Wai Choong

secure and reliable energy access need address in a comprehensive manner", he added.

The first area of focus is to develop bankable energy infrastructure projects that make sure that these projects are sustainable in the longer term, he said. The Asia-Pacific region may attract more than US$25 trillion of cumulative investments in generation capacity and grid infrastructure until 2040. He shared that more could be done to profile such projects to investors.

"Our aim is for Singapore to serve as a collaborative platform where energy infrastructure developers, consultants, governments, financial institutions – including Multilateral Development Banks – and institutional investors come together in a vibrant and multi-faceted ecosystem. Working together, we will be able to activate and mobilise the essential ability, capital, and insights, to help meet the energy needs of the region", Mr. Iswaran said. On this front, IE Singapore has worked with the Asian Development Bank on the Asia Infrastructure Centre of Excellence to help to create bankable infrastructure projects in the region, he informed.

Utility companies and Singapore's research institutions are also driving innovation in related technologies, the Minister said.

ENGIE Lab Singapore, established in July this year is one such company that will serve as an Asia-Pacific Centre of Excellence for low-carbon and distributed energy resources. Another such company

L to R: Ms Rachel Kyte, Moderator Jegarajah and Mr. David Gray during the opening keynote panel at SIEW 2016

To secure affordable, reliable and sustainable energy for all policymakers need to prioritise closing the energy access gap when developing the vision for future energy systems: Rachel Kyte

is Sun Electric, a Singapore-based technology company focusing on urban solar solutions. Nanyang Technological University of Singapore is leading the Renewable Energy Integration Demonstrator-Singapore, REIDS initiative on Semakau Landfill. This project focuses on the challenges of integrating different renewables into a micro grid and these solutions will give to energy access solutions in the region, he said.

The last area of focus is garnering international co-operation to unlock energy access options. "International cooperation is critical to promote innovative technological solutions, develop sustainable business models and increase access to financing and investments", Mr. Iswaran said. Singapore is hence working closely with partners to create a platform for interaction and sharing, with the goal of building relationships and exploring business opportunities, he pointed out. On this front, the G20 Energy Ministers are leading the discussions on energy access and have since June this year adopted action plans for the Sub-Saharan Africa and the Asia-Pacific region.

As part of Singapore's plans to enhance security of its natural gas supply by encouraging competition in its domestic market and further diversifying gas supply sources Mr. Iswaran apprised about the Pavilion Gas and Shell appointment as term importers for the next tranche of LNG for Singapore. Both

Arun Kr. Singhal, Chief Editor, DEW Journal discussing the energy scenario with Ms Rachel Kyte, CEO for Sustainable Energy for All (SEforALL) and UN Secretary-General Special Representative on the sidelines of SIEW 2016

'Asia needs to

Chief Editor, DEW in conversation with CEO, Sustainable Energy for All and UN Secretary-General Special Representative

What are SE4All's objectives for Asia, given that it will have more economic growth than other regions by 2050?

First, Asia needs to close its energy access gap and do so affordably with clean energy. This is a goal for 2030, but can and must be achieved earlier than that if the region's inhabitants are to enjoy the other goals we have agreed – in healthcare and education for example.

While we see that new business models for mini-micro- and off-grid solutions mean that renewables are cost-competitive and reach even the most isolated and marginalised communities, there is an infrastructure financing gap and it is not getting smaller. Significant work needs to be done with operators, investors and governments to find the connections that will allow investment in the smart modern energy infrastructure that Asia needs more quickly. We have to find new and inventive ways to try to close that gap. Many countries, developed and developing, have underinvested in infrastructure in the past. This has to become a domestic financial priority as well.

Second, our focus is on efficiency – the other renewable energy source. There needs to be substantial progress, in the near term, especially in the largest energy consuming economies, towards the goal of doubling the rate of efficiency. Increasingly, energy productivity will be a measure of long term economic stability and growth.

Chinese leadership in its hosting of the G20 where this is an issue, and the Clean Energy

importers will supply Singapore with 1 million tonnes per annum (Mtpa) of LNG each or for up to three years, whichever is reached earlier. The EMA also plans to allow third party spot imports and new piped natural gas imports on a case-by-case basis, he added.

"Even as we keep a close watch on current volatility in the market it is essential that policymakers, regulators and companies take a long term view of our energy landscape," said Mr Iswaran while talking to DEW.

Singapore will also be tapping on technological advances in smart metering solutions, Mr Iswaran shared. This will enable consumers to make informed decisions on energy consumption and conservation as well as help Singapore assess the feasibility of nation-wide deployment of smart metering solutions.

The following announcements were also made by Mr Iswaran earlier during his opening remarks at SIEW 2016:

- The government will consult industry on developing technical solutions for a smart metering trial including the development of a mobile application for enabling consumers to be more energy-efficient in real-time;
- The government's launch of a pilot programme – Project OptiWatt – for optimising energy consumption through demand management, with a MoU signed with 16 partners to explore initiatives to optimise energy consumption;
- Singapore's joining of the International Energy Agency (IEA) as an Association Country.

"Things that seemed like an interesting, distant possibility a few years ago, are quickly becoming the new reality of today," said Mr David Gray, Chairman of the UK Gas & Electricity Markets Authority (GEMA) delivering a keynote at SIEW 2016.

Improvements in energy intensity of 44% and 74% achieved by India and China between 1980 to 2011, demonstrate the potentials of what can be achieved: Rachel Kyte

The rapid advancement of the energy sector makes long-term policy-making more difficult. At the same time, the increasing importance of innovation and new technology presents society with exciting opportunities to meet strategic goals.

close its energy access gap and do so affordably with clean energy'

Ministerial in San Francisco are moments where Asian governments can take the lead in this efforts. In SE4All, we will concentrate on where the fastest gains can be made in order to show that, while difficult, progress is possible.

What will be the top three energy issues?

I think it is incredibly important to maintain momentum after a year of milestone agreements in 2015. It is essential to continue to find creative ways to close the access gap in those countries where it is hindering growth and development. It is essential that we translate political commitment into action on efficiency at the city and country level, and also at the level of companies.

When countries and companies commit to significant targets, this has a knock on effect in the financial markets. Understanding that global political agreement is being translated by companies into change in operational direction. That change in operational direction provides opportunities for financial companies to develop new services and products, as well as look at risks in their own portfolios.

We are also at an incredible moment in time given low oil prices. Now is the time to reset prices and ensure level playing fields that don't penalize new clean technologies and their new business models. Removing existing harmful fossil fuel subsidies, while it requires deft political skills, is an essential step in managing the economy for the long term goals.

There are some issues fundamental to our goals of access to clean, affordable, reliable power. I hope that SE4ALL can help spur the conversations forward where they may have become stuck or where they may not even begun.

Carbon capture, storage and use may be critical for some Asian economies, but how that will be financed seems an unfinished conversation. Where will we find the grant funding and concessional finance to ensure that the most marginalised and most remote communities have access to power where traditional and new business models may continue to struggle to operate?

The potential of private investment in promoting energy access is not to be under estimated. Developing countries need to find ways to realise private sector investment in energy access and enable scalable business models to emerge: Dr. Shamshad Akhtar

One such goal is the UN Sustainable Development Goal 7 – to secure affordable, reliable and sustainable energy for all, including the 1.1 billion people worldwide who have little or no access to electricity. To achieve this Ms Rachel Kyte, CEO for Sustainable Energy for All (SEforALL) and UN Secretary-General Special Representative, urged policymakers to prioritise closing the energy access gap when developing the vision for future energy systems. She added that the Paris Agreement on climate change, which has come into force on November 4, 2016, reiterates a key transition into a new energy future. Pursuing energy efficiency initiatives would be central in accomplishing these goals, said Ms Kyte while speaking at SIEW.

"It would seem especially short-sighted, if not foolish, to not act with determination to drive forward the cheapest, easiest and fastest way to meet development goals and the Paris Agreement," she emphasised.

Ms Kyte added the improvements in energy intensity of 44% and 74% achieved by India and China between 1980 to 2011, demonstrate the potentials of what can be achieved.

Both speakers agreed on the importance of developing the right policy and financing frameworks to allow renewable energy to meet its full potential to support global goals. "Technological development has substantially reduced production prices and accelerated renewable generation in the UK and elsewhere, with storage technologies likely to follow – having seen costs fall by about 15% per annum," explained Mr Gray.

These smarter long-term investments must be supported with a level playing field and also be matched by more dynamic planning and operation of the energy system, Mr. Gray added.

To make the most of the rapid changes in the new energy realities, Ms Kyte said that policymakers would have to work towards their long-term vision in an iterative way. Agreeing Mr Gray said that the scenario-planning approach of the past few decades may no longer be sufficient. "Policies need to have clear objectives. Regulations need to set out clear principles and provide predictability to encourage investment but they also need to be flexible and vigilant to ensure that they do not close off new ideas or block off new approaches from the market."

Earlier Dr (Ms.) Shamshad Akhtar, under-Secretary-General the United Nations (UN) and Executive Secretary of the UN Economic and Social Commission for Asia and the Pacific (ESCAP) talked on technological advances and its impact on driving universal energy access in the region.

With increasing emphasis on sustainable growth and adoption of renewable energy there is a pressing need for Asia to put in place solutions to increase energy access. Dr Akhtar shared that "the region has the resources to give energy access, the challenge is how to use these resources effectively".

Today, about 15 billion people in South Asia have no access to energy. This unmet demand, unless met by modern energy solutions and sustainable sources, will continue to add to Asia's current greenhouse gas emissions as the consumer of 50% of the world's energy, she added.

With increasing emphasis on sustainable growth and adoption of renewable energy there is a pressing need for Asia to put in place solutions to increase energy access: Dr. Shamshad Akhtar

- Dr (Ms.) Shamshad Akhtar, under-Secretary-General the United Nations (UN) and Executive Secretary of the UN Economic and Social Commission for Asia and the Pacific (ESCAP)

"New ideas, technological advancements and creative market-driven financing solutions are fast instilling confidence that universal energy access is achievable within this generation", Dr Akhtar said.

There are a range of approaches that could help the region broaden energy access. "Renewable energy offers a major solution to energy access. Asia-Pacific is riding the global shift to renewable energy", Dr Akhtar said. The region, which accounts for close to US$160 billion in global investments in renewables is a key manufacturer of the world's renewable energy technology and is the global centre for the deployment of renewables, she shared.

The increasing cost competitiveness of solar compared to coal and gas and its widespread applicability have introduced new applications such as solar lanterns, solar home systems and solar-powered micro grids. This year, three large-scale solar projects in the Middle East and South America have contracted their solar generated output for US$0.03 per kWh, cheaper than other sources of electricity. Other technologies developed include energy storage, mini grids, bio-gas, hybrid systems and micro hydro power, she informed.

"Technological shifts have increased decentralised powered options" and in many cases these solutions are cheaper compared to grid extensions to remote locations, Dr Akhtar said. However, this requires a change in mindset for long-term infrastructure planning and developing countries would need to leapfrog to more efficient models of providing energy access. It is hence important to set up partnerships to take advantage of these trends and to scale up efforts, she said.

In implementing these solutions attracting and diverting finance to areas which need the most be tackled, Dr Akhtar said. The International Energy Agency (IEA) had estimated more investments for achieving universal energy access by 2030 which will reach US$640 billion globally and more than US$240 billion needed for Asia. She highlighted, diversion of fossil fuel subsidies to energy access initiatives could play a transformative role. Besides domestic resource mobilisation, other important channels to harness finance include climate finance, official development help, impact investing and green bonds.

The potential of private investment in promoting energy access is not to be under estimated. However, such efforts are being limited and the private sector accounts for only 18% of total investment. Developing countries hence need to find ways to realise private sector investment in energy access and enable scalable business models to emerge, Dr Akhtar said. This is possible only with the right enabling policy environment and supportive public policy to cut the associated risks of investing in these countries. In this aspect, many pioneering private sector firms have developed low-cost energy systems such as solar lanterns, biogas or micro-hydro systems and are rolling out business models with product, process and distribution innovations.

Dr Akhtar stressed that governments can accelerate progress in energy access through a comprehensive approach to mainstream energy access objectives into national development plans, dedicating financial resources, and providing supportive policy framework for the private investor and local communities. This include tax incentives, encouraging financial institutions to play a greater role in financing energy access, direct provision of finance at preferential rates, developing innovative private-public partnerships, enhancing technical and entrepreneurial skill sets, and encouraging productivity energy uses that can generate local incomes.

Besides carbon pricing, there are several factors that can help renewable energy options better meet Asia's growing energy needs: Ditlev Engel

Ditlev Engel

The recent adoption by G20 Ministers of the Action Plan for Enhancing Energy Access in Asia and the Pacific is a step in the right direction to help the region to adopt the proper policy framework to scale-up the private sector's role in enhancement of energy access.

With regards to modern energy solutions to help make sustainable growth for Asia, Mr Anil Sardana, CEO & Managing Director of Tata Power shared during the session "Asia's new energy realities", that there is an important role

for creative non-traditional solutions such as the use of distributed generation to give energy access and compressed natural gas which is a third of the cost of LNG.

In addition to innovative and more advanced energy solutions, Mr Ditlev Engel, CEO DNV GL – Energy emphasised creating a mechanism to show market-driven demand and supply.

Says Ditlev Engel, CEO, DNV GL – Energy while talking to DEW Journal: The challenge of the new reality is not so much the technology but

Your thoughts on the "New Energy Realities"?
This touches on the current energy transformation prompted by: technological innovations in renewables, batteries and control systems, and the ever more-pressing climate realities. The world is increasing its focus on climate change – an important step as its impacts are posing greater challenges to the security of Asia's energy infrastructure, and thus livelihoods.

Fortunately, we see exponential growth in the energy industry as many new technologies will reach the stage of maturity. Technology and innovation will move faster than we think. We have the technology to solve many of our challenges and the technology is getting cheaper and better for the foreseeable future. Take EVs, for instance. Switching to EVs is switching fuels and switching systems plus opening the prospects for a dramatic improvement in urban air quality and health. How can we bring the benefits of that new energy reality sooner? In that way EVs sum up the challenge and opportunity of the unfolding global energy transition and system transformation. The challenge of the new reality is not so much the technology, we have that, but getting policy and finance right.

In my mind the future of the electricity ecosystem will look like a Mandelbrot fractal, forming an intelligent 'plug and play' electricity grid in which every device down to our solar cells on the roof, and our coffee machines in the kitchen can communicate and adapt for an overall optimized generation, grid and demand performance. That won't happen overnight – but as usual probably much faster than we imagine today.

How would you assess the various renewable energy options for Asia's growing energy needs?
Renewable energy is crucial to Asia, as energy demand in most countries is rapidly growing due to industrialization and urbanization. Solar and wind are good solutions to meet this need, as they are faster to deploy than conventional energy technologies. Solar is also tremendously flexible, as it is viable on tiny rooftops and in large, utility-scale power plants. On top of that, energy efficiency greatly multiplies the value of these energy sources.

That said, it is still early days for solar and wind in much of Asia. People are understandably cautious and solar and wind energies are not perfect. Additionally, their capital cost is higher than that of conventional energy, leading planners and investors to perceive renewable energy as more expensive. Yet at scale, renewable energy is competitive with conventional energies – even coal – at a cost per kilowatt-hour basis. We are already seeing this in India, for example.

Renewable energy sources also bring value as they do not harm health, ecosystems or the environment. IMF and WHO estimates show that the health and environmental costs of using fossil fuels are astounding. If the prices of fossil electricity reflected this, they would be significantly higher than renewable energy. Carbon pricing, which we are beginning to see in China and South Korea, is an important step towards improving prices and decision making.

In addition to carbon pricing, there are several factors that can help renewable energy options better meet Asia's growing energy needs. These include an integrated systematic approach to development of solar and wind, adapted financing and business models that suit Asia's diverse economies, and accelerating the deployment and use of microgrids.

How will energy storage technologies impact the development of the utilities industry?
The share of renewables (particularly solar) in the electric power mix is rising rapidly, while prices continue to decrease. Commercial-scale grid parity for storage and solar PV is possible as early as in 2020, and utility-scale PV will start competing with traditional sources of peak and base load power by 2025.

As solar PV reaches or exceeds grid parity, it will become attractive for homeowners and companies to

To this, Dr Akhtar shared her suggestion of setting standards for the energy industry in the region to help understanding and progress of cross-border issues.

With regard to greater deployment of sustainable energy sources, Mr Luan Jun, Executive Vice President, State Grid Corporation of China, shared during the sesion how the Chinese grid operator implemented solutions to overcome the challenges

getting policy and finance right

Arun Kr. Singhal, Chief Editor, DEW Journal talking to Mr Ditlev Engel, CEO DNV GL – Energy about the new energy realities during SIEW 2016

invest in on-site solar PV systems, reduce grid dependence and become electricity prosumers. However, consumer-centric distributed renewable power systems will still require grid connection for flexibility services. Rapid up-scaling and cost reduction of on-site storage solutions will require a push from regulation or policy to reach economies of scale. Once (autonomous) microgrids become reliable, they will likely trigger the disruption of the power system, and the emergence of new business models.

Long-term investors are beginning to realise that climate change undermines the financial performance of their portfolios and, combined with the effect of regulatory mechanisms, this will drive an accelerated shift of investments away from coal-fired power and the extraction of marginally economic oil resources.

How could digitalisation stimulate innovation and competition in the market?

Integration of digital technologies into everyday life allows global interconnectedness 24/7 and offers the ability to combine, analyze and generate actionable knowledge from large and complex data streams in real time. Innovation opportunities also arise from the emergence of more 'intelligent´ digital systems that assist or replace human judgment or decisions.

As a result, digitalisation fuels technology innovation across industry sectors: helping society do things cheaper, faster and better; allowing individuals and businesses to obtain more control and influence; and pushing the boundaries of current technology frontiers.

Digital technologies also offer opportunities to better operate the ever-more densely woven web of mechanical and electrical systems in cities, including smart building applications, transportation systems, power grids, and water supply and waste removal networks. Optimizing the operation of city functions will require a digital sense process-respond system consisting of the following technology elements:

- Wired and wireless communication channels for transmitting and receiving signals
- Computers, mobile technology and microchips providing ubiquitous processing capability
- Sensors and monitoring devices connecting the digital and physical world
- Software infrastructure enabling remote operation of geographically distributed systems

Digitalisation will irreversibly disrupt existing business models and provide opportunities for new entrants into existing markets – but more importantly create new markets worth hundreds of millions globally. Digitalisation expands the scope and scale of virtual power plants.

That said, we must recognize the cyber security challenge raised by digitalisation. Already, power plants and power systems worldwide are subject to increasing attacks. Thankfully, most are not particularly successful. It raises a difficult question: should we digitise everything? Is that a risk worth taking with something as fundamental as electricity? In many cases the risk trade-off is going to be worth it, especially if concurrently we design systems that are safe to fail, that are anti-fragile. Even so, with some systems we might have to eschew the benefits of digitalisation because the impact of a small risk is simply too great. We keep an open mind.

'As the world transitions towards a lower carbon future there will be

Arun Kr. Singhal, Chief Editor, DEW talks to Mr. Simon Bridges, Minister of Energy and Resources, New Zealand

New Zealand has secured around 40% of its energy from renewable sources, how do you see this further growing?

The renewable energy used in New Zealand continues to reach record levels. Renewable energy provided 40.1 per cent of the country's total primary energy supply in 2015. This is a record high, placing us third in the world, behind other renewable superpowers Iceland and Norway.

Total primary energy supply is a measure of all the energy used domestically in a country. It includes all raw energy produced domestically (such as coal, oil and gas, hydro, wind, geothermal heat, and biomass) and all energy imported for use (such as petrol and diesel).

I'm a passion advocate of New Zealand's renewable advantage, made possible by our rich endowment of abundant energy resources.

As the world transitions towards a lower carbon future, the increased demand for renewable energy, coupled with the ongoing interest in energy security, has focused attention on geothermal energy. Worldwide installed capacity is forecast to double this decade. We are a world leader in geothermal energy, have world-class wind resources, extensive hydroelectricity, and forestry resources as a source for bio-energy. These resources have a key role to play in helping us transition to lower carbon future.

With 40% of primary energy from renewable energy sources, about 80% of electricity comes from renewable energy, primarily hydropower and geothermal power. Studies have shown that it is technically possible to offer 100% of the electricity demand by renewable power without risking with shortages in energy supply.

For the Asia-Pacific region in particular, which has many developing nations, this situation raises some big questions. Globally we are seeing low oil, gas and coal prices but at the same time we have to take significant steps to cut our carbon emissions if we are to manage the impacts of climate change.

What is your take on encouraging international clean energy collaboration?

The economies across the Asia-Pacific region are facing the triple energy challenge of sustainability, affordability, and security.

In the coming decades there will be unprecedented infrastructure investment across the region to meet the growing demand for energy. By 2035, energy demand in Southeast Asia alone is forecast to increase by 140 per cent. This will need almost a trillion dollars of investment. By 2040 Southeast Asia's energy import bill is set to more than triple to $320 billion dollars per year.

In 2015, global clean energy investment hit a record $329 billion, $179 billion of which was in the Asia-Pacific region. The Asia-Pacific Research Centre forecast the total energy investment during 2012 - 2040 between $24 - $73 trillion USD.

To meet this growing demand, policy makers will need to deploy all available assets at their disposal, whilst keeping a focus on clean, domestically generated energy. This will need significant financial resources and partnerships from the international community.

To deliver resilient energy systems and to deliver on our climate goals, I believe we need to enter an era of international clean energy collaboration and the amount of collaboration taking place in the energy sector recently are encouraging. At the Paris COP21, the International Renewable Energy Association (IRENA) launched the Global Geothermal Alliance to increase the share of geothermal energy in electricity

an increased demand for renewable energy'

generation and direct use of geothermal heat around the world. As a member nation, I believe New Zealand has a key role to play in the Alliance.

New Zealand is playing its part to promoting this future globally. Our world-renowned expertise in this area has seen many New Zealand companies offer technologies and solutions to harness and realise renewable energy opportunities in both developed and developing countries.

More collaboration and information sharing between key international organisations is vital to tackling the big issues of climate change, energy security and energy resilience. These are global challenges, which no single country or organisation can solve alone.

What do you say of our energy future?

We need to continue to build willingness to do things differently and awareness that energy efficiency and increased use of renewable potential are critical game-changers.

I also believe that, given the rapidly changing energy environment, it is time to set our priorities of how we want our energy future to look like.

As you are well aware, the argument around non-renewables versus renewables is far too simple. We need to recognise that not all non-renewables are equal and I believe gas will play an important role in transitioning to a lower carbon future.

> "Internationally gas is in major growth mode"

But there is still more to be done especially given the changing global context and conversations around our energy future.

Do you see natural gas as a bridging fuel to a lower-carbon global economy?

As the cleanest fossil fuel, countries are increasingly choosing gas as an alternative to coal for electricity generation. According to the United States Environmental Protection Agency, greenhouse gas emissions fell to their lowest level in 17 years in the world's largest economy, largely due to a rapid drop in coal-fired electricity, and the rise of electricity generated by cleaner fuels, particularly natural gas.

The International Energy Agency predicts natural gas demand will continue its expansion as the fastest growing fossil fuel, and speak of it as a very important bridging fuel to a lower-carbon global economy.

This role as a bridging fuel is even more relevant in the wake of the Paris Climate Change Agreement, as countries around the world take a hard look at their energy use and how they can cut their carbon footprint.

Internationally gas is in major growth mode. Japan, South Korea, China, and India are already big consumers of gas for electricity generation. There is real potential for significant growth in our most populous nations China and India, as they now rely heavily on coal.

To satisfy this burgeoning demand, tens of billions of dollars invested in LNG projects in Australia and this may soon eclipse Qatar as the world's largest LNG exporter.

with the intermittency of renewables such as solar energy generation. One solution was to optimise thermal and hydro power dispatch ability to help fill the gap of intermittency. Existing power sources coupled with better technology and storage systems also helped to cut the intermittency of renewables.

In his remarks during the session "Asia's new energy realities", Mr. Simon Bridges, Minister of Energy and Resources, New Zealand added that competition in the energy market is crucial and a key driver of the energy landscape.

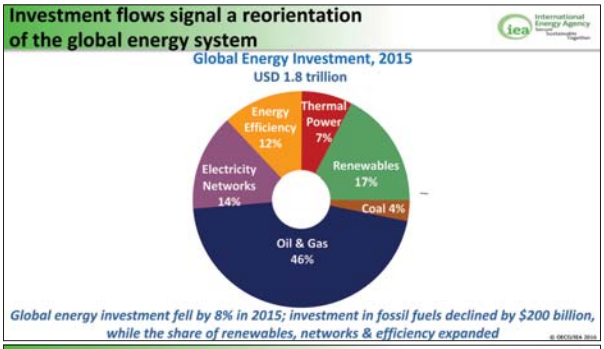
Mr Bridges highlighted the importance of aligning government policies and the needs of the nation and people towards more sustainable growth. In particular, he said that target setting was important and that the "government and regulators need to focus their mind and their nation to where they want to head for renewables".

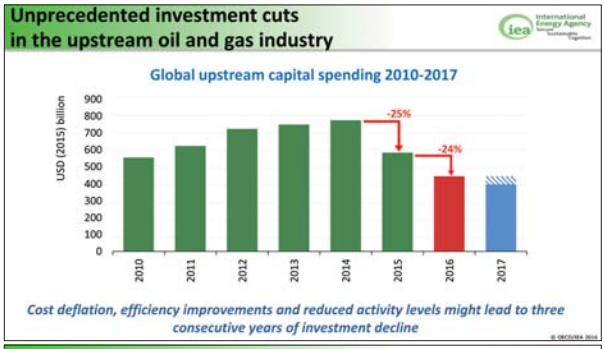
The panel concluded that the pace of development and uptake of sustainable energy sources and modern energy solutions would be different across countries in the Asian region. They assented that this challenge created a unique opportunity for the more developed countries in the region to help facilitate the progress of adoption in countries which are new to these solutions. If executed in tandem the adoption of innovative energy solutions and sustainable energy sources and better cooperation between countries would help increase Asia's energy access in a sustainable way.

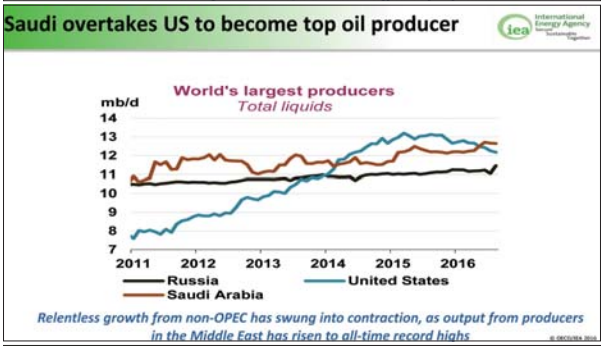
Addressing a luncheon

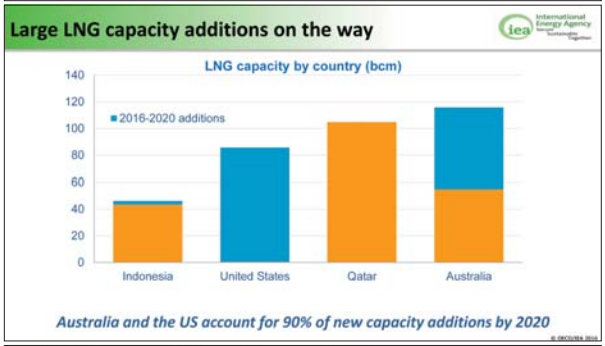
Dr Fatih Birol, IEA's Executive Director

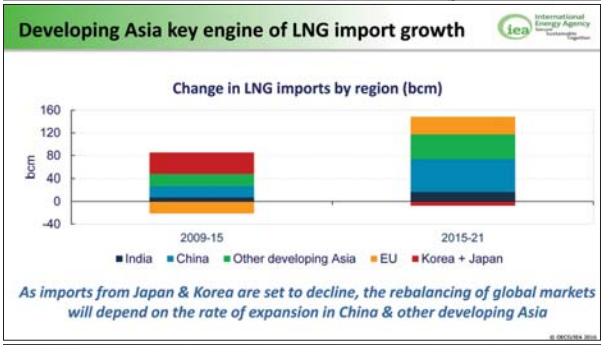
Volatile oil & gas prices and production has caused global energy investment to decline. Amidst the lower energy investment, investments are shifting toward renewables, networks and efficiency: Dr. Birol

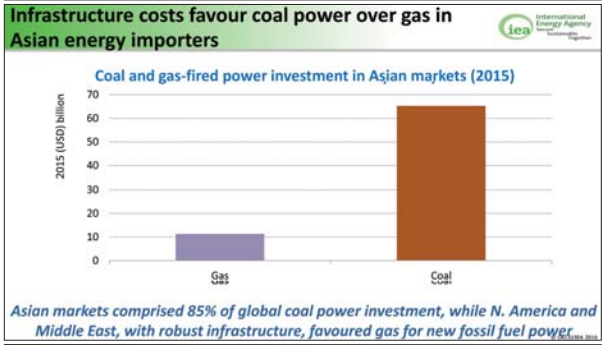


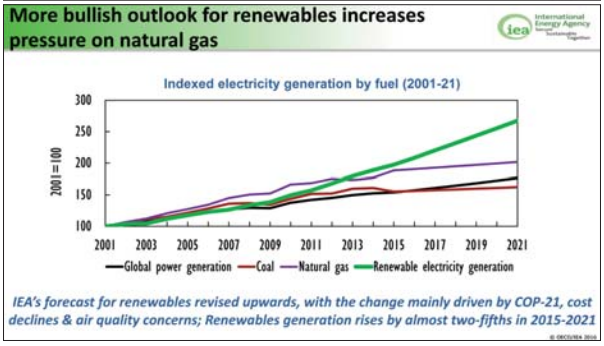


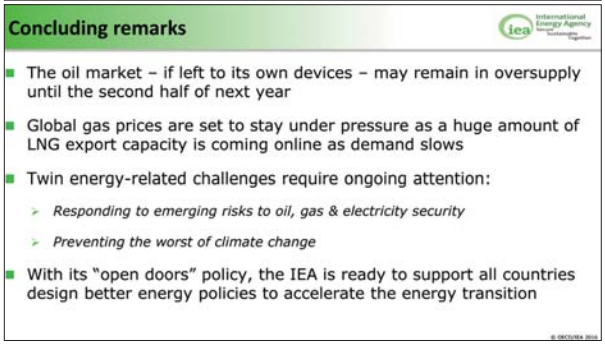












IEA raises its five-year renewable growth forecast

Chief Editor, DEW Journal in conversation with Executive Director, IEA

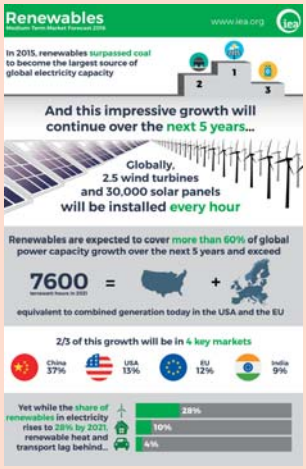
The International Energy Agency has said it is significantly increasing its five-year growth forecast for renewables thanks to strong policy support in key countries and sharp cost reductions. Renewables have surpassed coal last year to become the largest source of installed power capacity in the world.

The latest edition of the IEA's Medium-Term Renewable Market Report now sees renewables growing 13% more between 2015 and 2021 than it did in last year's forecast, due mostly to stronger policy backing in the United States, China, India and Mexico. Over the forecast period, costs are expected to drop by a quarter in solar PV and 15 percent for onshore wind.

Last year marked a turning point for renewables. Led by wind and solar, renewables represented more than half the new power capacity around the world. Most of the gains were driven by record-level wind additions of 66 GW and solar PV additions of 49 GW. About half a million solar panels were installed every day around the world last year. In China, which accounted for about half the wind additions and 40% of all renewable capacity increases, two wind turbines were installed every hour in 2015.

"We are witnessing a transformation of global power markets led by renewables and, as is the case with other fields, the center of gravity for renewable growth is moving to emerging markets," said Dr Fatih Birol, the IEA's Executive Director while talking to Arun Kr.Singhal, Chief Editor, DEW Journal on the sidelines of SIEW 2016.

"The center of gravity for renewable growth is moving to emerging markets"



There are many factors behind this remarkable achievement: more competition, enhanced policy support in key markets, and technology improvements. While climate change mitigation is a powerful driver for renewables, it is not the only one. In many countries, cutting deadly air pollution and diversifying energy supplies to improve energy security play an equally strong role in growing low-carbon energy sources, especially in emerging Asia.

Over the next five years, renewables will remain the fastest-growing source of electricity generation, with their share growing to 28% in 2021 from 23% in 2015.

The IEA also sees a two-speed world for renewable electricity over the next five years. While Asia takes the lead in renewable growth, this only covers a portion of the region's fast-paced rise in electricity demand. China alone is responsible for 40% of global renewable power growth, but that represents only half of the country's electricity demand increase.

"I am pleased to see he said that last year was one of records for renewables and that our projections for growth over the next five years are more optimistic," said Dr. Birol. "However, even these higher expectations remain modest compared with the huge untapped potential of renewables. The IEA will be working with governments around the world to maximize the deployment of renewables in coming years."

Dr Fatih Birol, IEA's Executive Director talking to Arun Kr.Singhal, Chief Editor, DEW Journal

plenary on the theme 'A world awash in oil and gas – What's next?', Dr. Fatih Birol, Executive Director, International Energy Agency (IEA) said volatile oil and gas prices and production has caused global energy investment to decline by 8% in 2015 – the lowest since 1960s.

The oversupply of oil is set to remain in global markets, with energy prices expected to remain lower for longer. Cheaper oil means producers need to squeeze the value out of every last drop. Production needs to be smarter by leveraging on new technology to cut costs to remain efficient and nimble. This session explored the implications and how the industry will adapt.

Rising oil and gas production by non-OPEC producers and Saudi Arabia have led to an oversupply in the market, he added. At the same time, large LNG capacity additions are coming in from Australia and United States.

Amidst the lower energy investment, investments are shifting toward renewables, networks, and efficiency. Renewable generation may rise by almost two-fifths between 2015-2021, driven by the Paris Agreement, lower costs of renewables and air quality concerns – which partly explains why China is champion in renewables, said Dr Birol.

New demand engines are developing in the Asian region, added Dr Birol. From not having any LNG importers in 2010, countries such as Singapore, Malaysia, Thailand and Indonesia are now importing it in 2016. It is therefore important to keep gas attractive, he said.

Despite this, investment in gas infrastructures continues to face competition from coal and renewables. 85% of global coal power investments come from the Asian market, with infrastructures costs favouring coal over gas.

By building coal plants future carbon emissions

Singapore becomes an IEA member country

Becoming an Association Country is particularly important for Singapore given its role as a regional energy hub in the heart of Southeast Asia

L to R: Dr Fatih Birol, Executive Director of the IEA; Minister of Trade and Industry (Industry) S. Iswaran; and Ng Wai Choong, Chief Executive of the Energy Market Authority

The International Energy Agency (IEA) has welcomed Singapore as an IEA Association country, deepening the partnership between both sides for a more sustainable and secure energy future. The announcement was made by Dr Fatih Birol, Executive Director, International Energy Agency (IEA) during SIEW 2016.

Becoming an Association country is particularly important for Singapore given its role as a regional energy hub in the heart of Southeast Asia - a rapidly developing region where energy demand is set to increase 80% by 2040 due to a booming population and robust economic growth.

The IEA Association provides a platform for the IEA to engage non-member countries to work together on issues including energy security, energy data and statistics, and energy policy analysis. It enables non-member countries to participate in a variety of activities, including IEA standing groups, committees, and Ministerial meetings.

ACE- IRENA joint report

ASEAN Centre for Energy
One Community for Sustainable Energy

The ASEAN Centre for Energy (ACE) and the International Renewable Energy Agency (IRENA) has launched their joint report titled Renewable Energy Outlook for ASEAN: A REmap Analysis during the SIEW 2016. The joint report looks at ASEAN's renewable energy potentials, costs and benefits by applying IRENA's REmap analytical methodology and tools at a country level. Most importantly, it provides detailed technological and sectoral options for ASEAN Member States to close the gap between the current and targeted share of renewables in the regional energy mix.

According to the report, the combined energy demand of the 10 (ten) ASEAN Member States will grow by around 50% by 2025. This will increase emissions by 60% and generate USD 225

checked. It is therefore imperative that climate change be addressed when energy discussed said Dr Birol.

"There are certain areas I think the gas industry has to look carefully at to make fuel more attractive. This includes bringing more flexibility in the contracts and giving a second look into some issues such as the destination clause," said Dr Birol.

Natural gas still has an important role, said Charif Souki, co-founder and Chairman of Tellurian Investments.

"With low prices, you are already seeing demand coming from different places, even in the Middle East, demand for natural gas is increasing very rapidly," said Mr Souki.

Natural gas has helped reduce carbon emissions in the United States by 12% over the last five years, added Mr Souki.

Speaking on the transition to a low carbon future the experts were of the opinion that this is a global reality that is dependent on many factors such as renewable energy cost reductions and commitments towards international climate agreements.

> Asia will be important for nuclear growth and the outlook for new nuclear built in the region is promising. New nuclear capacity globally hit a 25-year high in 2015, with more than two-thirds coming from South and East Asia: DG, WNA

To achieve an effective transition, a broad multi-sectoral approach is essential, said Sakari Oksanen, Deputy Director-General, International Renewable Energy Agency (IRENA). He added that other sectors besides electricity, such as buildings, transport and industry would require "very determined government

indicates, achieving renewable energy target saves the region money

IRENA International Renewable Energy Agency

billion per year in associated health and pollution costs. When considering these costs, the savings generated through achieving the aspirational renewable energy target of 23% in the region's total primary energy supply by 2025 (decided in the 33rd ASEAN Ministers on Energy Meeting, Malaysia 2015), are far greater than the associated costs required to do so.

The launch of Renewable Energy Outlook for ASEAN: A REmap Analysis was organised with a roundtable discussion moderated by IRENA's Deputy Director General, Mr. Sakari Oksanen. "ASEAN has set an aspirational target to source 23% of energy from renewables, and according to current planned policies the region would only achieve 17%, leaving a 6% gap. To close that gap, a concerted effort to deploy renewables across all sectors from power, buildings, industry and transport is needed. The REmap Analysis shows that closing this gap is feasible and cost-effective, resulting in significant savings when accounting for lower levels of CO2 and air pollution, and also in a more secure and sustainable energy system " said Mr. Oksanen.

ACE's Executive Director, Dr. Sanjayan Velautham, explained during his presentation that this report is part of ACE's efforts to step up collaboration with international organisations to benefit from their

L to R: Mr. Sakari Oksanen (IRENA), Mr. Eugene Toh (EMA Singapore), Ms. Maritje Hutapea (Ministry of Energy and Mineral Resources, Indonesia), Dr. Sanjayan Velautham (ACE), Mr. Maria-José Poddey (GIZ), Ms. Cecilia Tam (APERC), Dr K. Theerarattananon (DEDE, Thailand)

expertise and enhance capacity building in the region's experience-sharing. "This fits particularly with the direction the 10 ASEAN Member States are heading to with renewable energy, as set under the ASEAN Plan of Action for Energy Cooperation 2016-2025," he added.

To date, the study has engaged all 10 ASEAN Member States and more than 60 experts through in-depth technical workshops and review webinars. It has also received support from the Renewable Energy Support Programme for ASEAN, a project jointly implemented by ACE and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ).

action" to facilitate deployment of low carbon technologies.

Businesses play an important role as well. Peter Schwartz, Senior VP, Global Government Relations and Strategic Planning at Salesforce.com, said that businesses have key roles in enabling low carbon technologies, communicating information to the public and encouraging facilitative government policies.

Sharing his view at the session "Building a low-carbon future", Director General of the World Nuclear Association (WNA), Agneta Rising, said that "Nuclear is a key stone if we are going to solve the puzzle of a low carbon future". Echoing his views Masakazu Toyoda, Chairman and CEO of the Institute of Energy Economics, Japan (IEEJ) added the importance of providing greater information to improve public understanding on nuclear energy, including aspects such as nuclear safety, in order to facilitate nuclear adoption and public acceptance.

The World Nuclear Association (WNA) envisions nuclear power to supply about 25 per cent of the world's electricity demand by 2050, said Agneta Rising, Director General of WNA, during the launch of the World Nuclear Performance Report 2016 – Asia Focus at SIEW Energy Insights.

To achieve this, WNA has set a target for 1000 GWe of new nuclear capacity to be added by 2050.

Asia will be important for nuclear growth and the outlook for new nuclear built in the region is promising, said Rising. New nuclear capacity globally hit a 25-year high in 2015, with more than two-thirds coming from South and East Asia, she added.

"Asia is dominating (in nuclear growth). Thirty nine of the reactors are in Asia, with hundreds more already planned," said Rising.

Reactor performance has also improved, increasing to a global average capacity factor of more than 80% from the 60% of the past. Capacity factors in East Asia are especially high, generally exceeding 80% to 90%.

That said, nuclear has to grow two to three times from current levels if climate change targets are to be met – and more has to be done to expand the role of nuclear energy.

Wind and solar in Germany only generates a third of France's total nuclear capacity, despite more installed capacity and higher cost, said Rising. "Nuclear is the only option (to achieve decarbonisation of electricity) if we have a limited budget and

The experts are of the opinion that the transition to a low carbon future is a global reality that is dependent on many factors such as renewable energy cost reductions and commitments towards international climate agreements. To achieve an effective transition, a broad multi-sectoral approach is essential: DG, IRENA

L to R: Mr. Sakari Oksanen, Deputy Director General, International Renewable Energy Agency (IRENA), Mr. Masakazu Toyoda, Chairman & CEO, The Institute of Energy Economics, Japan (IEEJ), Ms. Agneta Rising, Director General, World Nuclear Association (WNA), Mr Jon Moore CEO, Bloomberg New Energy Finance, Datuk Ir. Ahmad Fauzi bin Hasan, CEO, Energy Commission of Malaysia, Mr. Steve O' Nell, CEO, REC, and Mr. Peter Schwartz, Senior Vice President, Global Government Relations & Strategic Planning, Salesforce.com

a limited time."

Jeremy Gordon, Head of Information Management, WNA, said that nuclear is a competitive energy source compared to fossil fuels, and that externalities such as reliability and pollution are important considerations as well.

Other key areas addressed were education and safer reactor designs to improve public acceptance of nuclear energy. Skilled labour is also an important factor for building nuclear capacity.

Datuk Ir. Ahmad Fauzi bin Hasan, CEO of the Energy Commission of Malaysia emphasised that governments needed to put in place policies to drive the clean energy agenda; for example, by enabling good energy financing mechanisms the cost of clean energy can be further reduced. He stressed that "without the right enabling environment in terms of policies, and legislation if necessary, things won't move."

Energy connectivity to the rural population is a challenge faced by

'Asia Pacific is expected to be a promising market for energy projects'

Luca Tonello, Head, Project Finance Asia, Sumitomo Mitsui Banking Corp. on the 'New Energy Realities' while talking to DEW

What are your thoughts on the "New Energy Realities"?

We have indeed entered a new era of energy markets. Crude prices took a plunge in 2H 2014 and have yet to recover to above-$60 level. Consumers, however, have benefited from the availability of cheaper fuel by driving more miles on the road and switching to bigger vehicles such as SUVs. On top of that, with technical advancements and improving economies of scale, the cost of owning an electric or hybrid vehicle has been vastly reduced. This could catalyse a switch from fossil fuel to electricity in the transportation space, and potentially disrupt the oil industry.

The concern is how quickly companies would be able to ramp up production and add new reserves down the road with the ongoing cuts to development and exploration expenditure. Some majors have already failed to replace 100% of their depleting reserves last year, and at some point they need to spend capital again to bring new production online. As financiers, we are looking to support energy companies with necessary funding to help meet the world's growing need for energy.

Which are the most promising growth markets in Asia Pacific for energy projects?

As a region overall, Asia Pacific is expected to be a promising market for energy projects, in comparison with developed economies with deflated demand outlook. However, it is hard to pin down a particular segment in the energy industry that fits with the whole region as each country has its own natural resources, geology, and climate conditions. For instance, geothermal projects have huge potential in countries such as Indonesia and the Philippines. Solar and wind are increasingly significant in the power mix of China and India. LNG has started to make inroads into frontier markets such as Pakistan, and possibly Bangladesh and the Philippines in the not too distant future.

On the other hand, coal will remain an anchor fuel for power generation in Asia Pacific for the foreseeable future – in both emerging markets such as China, India, and Indonesia, as well as in developed economies such as South Korea and Japan. In spite of its stated ambition to tackle overcapacity, China is still expected to build one new coal-fired power plant a week on average until 2020. South Korea, one of the world's top LNG importers, is also calling for more coal in the country's power generation mix. Countries will need to balance consumer views with security of supply and rationale of economics in developing their policy for the future energy mix.

Regardless of the type of energy projects, reliable cash flows and proper risk allocation among different stakeholders are fundamental drivers to procure funding. Additionally, government, investors, and financiers should also take into account a number of considerations specific to the host countries, such as tariff affordability, access to resources and infrastructure, alignment with existing projects, and standardisation of technology and specifications.

"We are looking to support energy companies with funding to meet the world's growing need for energy"

L to R: Mr. Gireesh B. Pradhan, Dr. Fatih Birol, Datuk Seri Panglima Dr Maximus Johnity Ongkili, Ms. Rachel Kyte, Mr. Simon Bridges and Mr. Wong Kim Yin

both developed and developing countries in their efforts to achieve energy access for all, said panellists.

It is important for governments in Asia to work together on setting uniform policies around the financing of energy infrastructure. Doing so will help the region achieve a certain level of stability that is necessary for attracting capital for energy infrastructure, said Mr Gao Jifan, Chairman & CEO of Trina Solar, while speaking at the "Energy Financing - Bridging the Gap" panel at the Singapore Energy Summit.

Within Asia, most banks prioritise reliable contracts and regulations ahead of economic substance when assessing the bank ability of projects. "A stable regulatory environment is always a big factor in our region to make things work," said Mr Luca Tonello, Deputy General Manager & Head of Project Finance Asia at SMBC.

Facilitating an environment that attracts energy infrastructure capital is an important task on a regional and global level. According to Mr Luca Tonello, the "scale of the global debt market for energy infrastructure is approximately $250 billion to $300 billion dollars a year" and it continues to evolve. For example, SMBC's project involvement has radically shifted to solar energy and other renewables in the next six months.

AGL Energy is similarly shifting its investments. Mr. Andy Vesey, Managing Director and CEO said AGL Energy currently contributes to the emission of 44 million tonnes of carbon dioxide each year as a result of its operation of three coal plants. That said, the company has committed to close these coal plants at the end of their useful life and not to finance the construction of new coal plants. Moving forward, they face the challenge of encouraging "the market to make good investments when there already is overcapacity, without giving great subsidies for European technology". Renewals will need to be carried out in a managed way in order to mitigate volatility and risks to financiers.

As the types of investment – and technologies behind them – rapidly change, so will the price points of projects. This also leads to risks for financiers, as financing for energy infrastructure projects is typically between 15 and 20 years.

Access to energy is not only about connectivity, but also quality and affordability: Dr. Maximus

Arun Kr.Singhal, Chief Editor, DEW Journal and Datuk Seri Panglima Dr Maximus Johnity Ongkili, Minister of Energy, Green Technology and Water, Malaysia during SIEW 2016

Access to energy is not only about connectivity, but also quality and affordability, said Datuk Seri Panglima Dr Maximus Johnity Ongkili, Minister of Energy, Green Technology and Water, Malaysia.

Renewables, micro-grids and off-grid solutions were shared as means of overcoming the high infrastructure costs of last mile connection. Sabah, for example, he said has managed to achieve 95 per cent access to energy over the past few years, with the help of off-grid solutions and about US$30 billion of investment annually.

More investment is needed to develop these alternative solutions further – and regulators play an important role in this, said Mr. Gireesh B. Pradhan, Chairperson and CEO, Central Electricity Regulatory Commission (CERC), India.

Addressing Energy Access Forum session on 'Energy Access Challenges and Opportunities' later

during the event, Dr Fatih Birol, Executive Director of the International Energy Agency (IEA), said that having the right policies and regulations in place provide investors with the confidence to support alternative solutions. This is how China has provided energy access to about 500 million people over the past 11 years, he added.

The often-cited last mile can be the first one using decentralised business models, new public financing and investor interest, said Rachel Kyte, CEO, SEforALL initiative. As the price of renewable energy technologies plummets, it is possible to imagine that the energy access gap can be closed sustainably.

Around 100 million people in ASEAN do not have access to electricity, said Dr Sanjayan Velautham, Executive Director, ASEAN Centre for Energy while speaking during panel on "Energy Access in ASEAN". Of these, 53 per cent are located in remote areas.

Providing access to these people has its challenges. One example is the process of efficiently getting payment for power delivery. Technical solutions such as mobile financial services have become a common practice in developing countries and could be adopted in these remote areas. "Every nine out of ten homes have a mobile phone", said Didar Islam, Founder of Solaric Global. However, charging the phone is itself a big issue if they do not have access to the right voltage.

Governments have a significant role to play in delivering this energy access. For example, the Indonesian government is planning to invest in 35,000 mega-watts of new power in the next four years to increase the country's electrification ratio to about 99 per cent from around 88 per cent today. Another initiative highlighted by Mr. Peter du Pont, Senior Climate Change Advisor at the US Agency for International Development (USAID) Asia, was the US-ASEAN Connect. The initiative, which was established by President Obama at the US-ASEAN Special Leaders' Summit in Sunnylands, California, has established centres in Singapore and Bangkok. Together, they connect businesses, thought leaders and educational institutions to bring sustainable clean energy to the region.

Cambodia is yet another example of the impact of a government's role. Speaking at a panel, Dr Ith Praing, Secretary of State, Ministry of Mines and Energy, Cambodia,

Arun Kr.Singhal, Chief Editor, DEW Journal and Mr. Gireesh B. Pradhan, Chairperson and CEO, Central Electricity Regulatory Commission (CERC), India during SIEW 2016

said that the Royal Government of Cambodia in its effort to achieve rural development, reduce poverty and improve the quality of life for people who are living in the rural areas – continues accelerating the development of rural electrification fund to ensure that all households have access to sustainable electricity supply at reasonable tariff. To date, about 73 per cent of villages and more than 60 per cent of households had benefited from the rural electrification fund and have access to grid quality electricity in Cambodia.

There is still much to be done to secure energy access for Asia's remote areas. When it comes to the region's energy goals, "it's not just about…providing more and cleaner energy to the people who already have some," said Mr. Mark Gainsborough, Executive Vice President of New Energies at Shell while speaking at Energy Access in Focus – Technology and Investments at SIEW 2016. "It is also extending energy to those who have not had the chance."

Investments in renewables such as wind, solar, hydropower and micro-grids are helping expand

Experts during the Energy Access Forum on "Energy Access in Focus - Technology and Investments

Arun Kr.Singhal, Chief Editor, DEW Journal discussing with Mr. Pål Rasmussen, Secretary General, International Gas Union (IGU) how air quality can play a key role and encourage collaborations

access to those without. Partnerships with social entrepreneurs can go further, creating good, sustainable solutions that improve the lives of people, agreed Mr. Jan Flachet, CEO, ENGIE Asia – Pacific and Mr. Gainsborough. As an example, Gainsborough cited the global Alliance, a multi-stakeholder, public-private partnership founded by Shell Foundation.

Established in 2010, the Alliance aims to foster the adoption of cleaner cooking solutions in 100 million households before 2020. In addition to these partnerships, government plays an important role. "Changes in regulatory framework is absolutely key to get private sector to be comfortable in (investing in remote areas)," said Mr.Allard Noovy, CEO, InfraCo Asia.

Mr. Noovy added that enabling legislation, like the feed-in-tariffs in the Phillippines, provides financial incentives for clean energy investments. On the other hand, Mr. Arun Sen, CEO of Coromandel Advisors, Mr. Matthew Peloso, founder and CEO of Sun Electric, and Mr. Gainsborough said that it is more important to push deregulation, incentivising investors to find market-based solutions.

They also highlighted pragmatism and affordability as key considerations for rural areas. On this, Mr. Peloso added that the use of small-scale solutions that do not require transmission lines can empower consumers. In the case of Africa, a US$50 solar/battery device powers people's basic needs of telecommunication and lighting.

Panellists agreed that financing new technology projects such as this remains an issue. Investors are cautious as they are used to traditional or old energy business models. Hence, it will take time for new technology projects to be adopted. Investors' risk appetites differ and there is no one-size-fits-all solution, yet investor education around new technologies and renewable energies is critical to interest, said Mr.Sen.

Despite the challenges, Mr. Sen said that financers and governments are increasingly open to exploring and experimenting with new and small-scale technologies. We should therefore see more developments and more connectivity to remotely-located people, he said.

Speaking during the session on "Unlocking options - Global Collaborations on energy access", Mr. Pål Rasmussen, Secretary General, International Gas Union (IGU) said, "Whether that is working or not is very hard to measure". Mr. Rasmussen highlighted air quality as an area in which collaboration can play a key role.

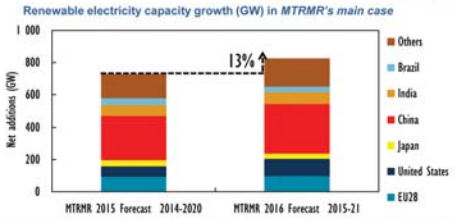
An estimated 3.7 million people die each year due to poor urban air quality, according to the World Health Organisation. The sharing of urban air quality reports, conversion of energy sources to gas, and other measures help improve this figure. Yet there is still a long way to go. Mr. Ramussen called on the renewables and gas industries to stop working in silos and to start sharing expertise and resources for greater impact.

Mr. Akash Gupta, Under Secretary, Investments Technology Promotion and Energy Security Division, Ministry of External Affairs, India while speaking at the Unlocking Options – Global Collaboration on Energy Access panel called for global agencies to avoid duplicating efforts. Consistent coordination and thoughtful implementation would help to resolve worldwide challenges such as energy access. He shared three interesting examples of such collaborative efforts in India that help to implement energy access solutions.

The first is capability building programs such as Barefoot College. Barefoot College, which was started by an Indian entrepreneur trains people living in rural areas to install and maintain solar installations in their homes. "Today, the trainees of Barefoot College span across 1,300 villages in almost 80 countries in the world," said Mr. Gupta. As a result, 500,000 more people now have lights in their homes.

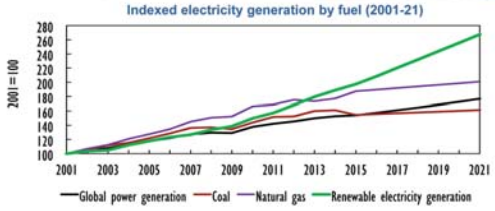
Secondly, the Indian government requested for

New policies underpin a more bullish forecast for renewables



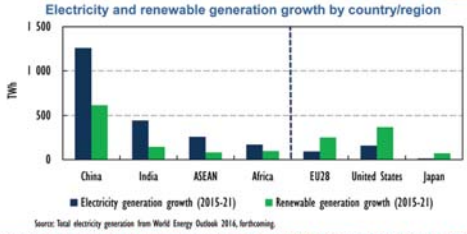
China remains key growth market for renewable capacity, while the United States surpasses the EU for the first time

Renewables to remain fastest growing source of electricity generation



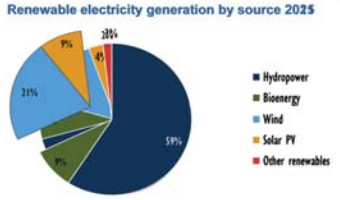
Generation from renewables to rise by almost two-fifths over 2015-2021, pushing their share of total electricity generation from 23% to 28%

A two-speed world for renewable electricity



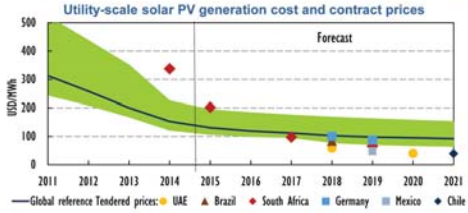
The increase in generation from renewables in 2015-2021 represents 60% of the global increase in electricity output, but prospects vary across regionally

Wind and solar PV compensate for slower hydropower growth



Solar PV & wind account for almost 2/3 of rise in renewables generation; total renewable electricity overpasses 7600 TWh by 2021, equivalent to EU+US today

Solar PV costs continue to decline with increasing competition

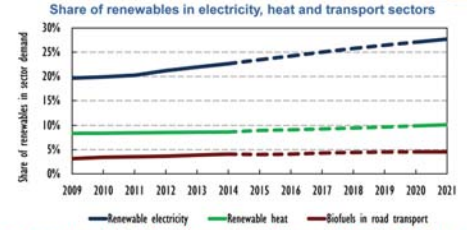


Utility-scale solar PV generation costs to fall by another quarter over 2015-21; competitive tenders may result in even faster cost reductions

More ambitious policies could further enhance the outlook in line 2°C target

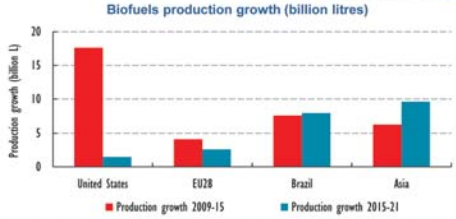
Renewables are in line with NDC pledges by 2030 but reducing policy uncertainty and overcoming financing & grid integration challenges remain key to achieve 2°C target

Renewables to dominate electricity growth, but less progress in heat and transport



The share of renewables rises in all sectors, despite persistent challenges in heat & transport; interactions between energy efficiency & renewables become critical

Biofuel production shifts to Asia, as EU and US slows



Structural challenges in the US & policy uncertainty post-2020 in the EU slow growth; Thailand, India & Indonesia have strengthened policies despite low oil prices

Conclusions

- Prospects for renewables electricity revised upwards, driven by policy improvements, cost reductions & efforts to improve air quality
- The impact of lower fossil fuel prices on renewables varies by sector. Wind (onshore) & solar PV are the only technologies on track for a 2°C scenario
- Competition in Asia between renewables & coal/gas will be critical to meeting global decarbonisation targets
- Attracting investment in renewables hinges on appropriate market rules & regulations, particularly in markets with slow electricity demand growth
- IEA is working to accelerate energy transition with its analysis on policy & technology and system integration of renewables

volunteers to give up their cooking gas subsidies. This led to savings of almost US$500 million per year – funds that were redirected to energy access initiatives serving rural households.

The last is the LED revolution in India, in which the government aims to distribute 700 million LED bulbs by the end of next year. This will ultimately result in lower electricity bills for households.

In addition to collaboration and the role of the public sector, the private sector must also be involved. Liu Hongpeng, Chief, Energy Section, UN Economic and Social Commission for Asia and the Pacific (ESCAP) highlighted the need to match private sector funds to the places that require energy access the most. Traditionally, private companies are concerned with the profitability and risks involved in providing energy access to rural areas. Governments must consider the policy needed to stimulate private sector investment, as Public Private Partnership is needed to support local communities and joint ventures.

SIEW ENERGY INSIGHTS

During the SIEW Energy Insights key energy thought leaders who spoke were EMA's Chief Executive Mr Ng Wai Choong, Dr Fatih Birol, Executive Director, IEA and Ms.Agneta Rising, Director General of World Nuclear Association.

Dr Fatih Birol, Executive Director, IEA shared key findings from the IEA Medium-Term Renewable Energy Markets Report 2016.

"2015 was a record year for renewables," said Dr Fatih Birol, as he launched the IEA Medium-Term Renewable Energy Market Report 2016 at SIEW Energy Insights.

Dr Birol attributed this success to two factors: the cost of renewables coming down, and strong renewable policies provided by governments. "For the first time, the addition of renewables (capacity) surpassed fossil fuels and nuclear," said Dr Paolo Frankl, Head, IEA's Renewable Division. Renewables like wind and solar are projected to grow in the double digits, making them the fastest growing energy option.

It was acknowledged that this will not be sufficient to achieve the 2°C climate change target, as policy uncertainty, grid integration issues and financing are limiting growth. When it comes to decarbonisation, bio-fuels will be critical for transforming the transport sector. "The transport sector is the most difficult to decarbonise," and "with no policy intervention, advanced bio-fuels will not progress". The decarbonisation of heating will also be important, as heating is one of the most significant contributors to carbon dioxide emissions.

Dr Birol encouraged governments, especially those in the ASEAN region, to put in place attractive investment and policy frameworks to promote the growth of renewables over coal and gas.

Ms. Agneta Rising, Director General of World Nuclear Association shared the insights on nuclear performance in Asia. The World Nuclear Performance Report 2016 – Asia focused the concrete progress by the nuclear power industry in boosting electricity generation and the constructing nuclear reactors faster than at any time in the last 25 years, both of which are needed to secure our energy supplies and fight climate change. With authoritative performance data for the global industry, the report has a special focus on developments in Asia, where most growth in the nuclear industry is actually taking place.

SIEW 2016 ROUNDTABLES

Roundtables at SIEW 2016 were short but intensive sessions designed to involve a small cohort of participants engaging in debate and progressing their priorities in extended discussion. These made excellent venues for giving and receiving targeted feedback and for meeting like-minded industry peers in in-depth debate on case studies or materials. The roundtables provided unique opportunities for learning and professional exchange of ideas and thoughts. The round-tables of debate and discussion during SIEW 2016 wrapped up the following:

Roundtable A

Outlook on Asian LNG – Market Dynamics and Pricing.

Experts during the Roundtable discussion at SIEW 2016

Experts during the Roundtable discussion at SIEW 2016

The major discussion points of this round-table were as under:

The roundtable by the Institute of Energy Economics, Japan (IEEJ) discussed rapidly evolving market dynamics and pricing changes in the LNG industry that have opened a unique window of opportunity to revisit the traditional characteristics LNG contracts.

Natural gas is anticipated to "stay as our future, irrespective of the uptake of renewables", declared Mr. Damien Criddle, founder and CEO of LNG trading platform GLX. In fact, a quarter of global primary energy consumption by 2040 is expected to be fuelled by natural gas, said Mr.Yukari Yamashita, Director, IEEJ.

Looking forward, traditional long-term oil-indexed contracts face an increasing number of challenges from volatile oil prices and the need for greater flexibility in today's market. For example, the uncertainty surrounding nuclear restarts in Japan, one of the largest buyers of LNG globally is driving the move away from traditional long-term oil-indexation of LNG contracts. Sendai Units 1 and 2, and Ikata Unit 3, came back online last year following the shutdown of nuclear plants in Japan after the 2011 Fukushima crisis. This slowed Japan's demand for LNG to fuel natural gas power plants. Political will and societal acceptance in Japan for further restarts is still unclear.

The introduction of many smaller independent oil and gas producers has further fragmented the oil and gas industry. These have been crucial drivers in the transition towards smaller, shorter-term contracts. To achieve this transition, the industry must first develop three key areas: a credible LNG price index, increased gas-on-gas competition, and more flexibility in the legal drafting of LNG contracts.

"From the utilities point of view, having an index that is not linked to a physical trade is something very difficult to accept," said Keita Enjoji, Head of LNG for Tokyo Gas Asia, when noting the challenges of forming a liquid LNG price index in the region.

"A successful price index must be "reliable, credible, transparent and liquid," added Nandukumar Ponniya, Principal at Baker & McKenzie. While Singapore holds an advantage as a trusted hub for oil trading, this has not yet translated into a successful LNG trading hub.

Other crucial developments required a transition away from long-term oil-indexation of LNG contracts; the inclusion of gas-on-gas competition, which Japan will be enhancing via the introduction of gas retail market reform by 2017; and a restructuring of the gas pipeline regulations by April 2022, said Mr. Enjoji.

Legally, Mr. Ponniya said that the transition would also be facilitated by new contracts which remove the onerous destination-closed and Take-or-Pay clauses in today's traditional contracts, and include price review clauses for greater price and volume flexibility.

Nevertheless, barriers remain high for the LNG industry's transition, as the creation of a regional LNG price index faces substantial challenges in the form of diverse economic and geopolitical circumstances for countries, even within Asia. Existing long-term contracts also pose a significant difficulty for price formation, as the art of price discovery remains elusive for the LNG industry.

In the short term, Mr. Punniya said he saw an opportunity for regional LNG indices to enter the fray by providing price diversification for large portfolio players. Despite the challenges facing this transition away from traditional LNG contracting strategies Mr. Criddle concluded that market dynamics and low oil prices mean that "the door is open for the discussion – this is the moment to be had."

Roundtable B

Accelerating Low-Carbon Technology Transfer – Helping Developing Countries Implement Nationally Determined Contributions. The major discussion points of this round-table were as under:

The panellists during the roundtable hosted by the Asian Development Bank (ADB) focused on many challenges that still lie ahead for Asian countries to meet the Nationally Determined Contributions (NDCs) they committed to in the Paris Agreement.

Developments in low-carbon technologies have placed Asia in a much better position to meet these

NDCs but more can be done to aid technology transfer, said Mr. Venkatachalam Anbumozhi, Senior Energy Economist at the Economic Research Institute for ASEAN and East Asia (ERIA), Indonesia. For example, there is a need for free trade agreements, where tariff and non-tariff barriers are removed, to provide more access to technologies in a cost-effective way.

Another challenge highlighted was the high risks associated with developing and adopting low-carbon technologies.

There is uncertainty about these technologies due to the scarcity of information and statistics on their benefits, said Mr. Pham Van Tan, Deputy Director, General, Department of Hydrology, Meteorology and Climate Change (DMHCC), Ministry of Natural Resources and Environment (MONRE), Vietnam.

The lack of proper methodology to monitor low-carbon technologies further hinders this, said Professor Tan Xianchun, Deputy Director, Center of Overall Planning, Safety and Security Management, Institute of Policy and Management, Chinese Academy of Sciences. To inform China's 13th Five-Year Plan and its long-term low-carbon policy, pilots have been conducted at provinces and cities in China to collect the necessary data, she added.

Incentives and skill sets to deploy and operate low-carbon technologies are also lacking. In Vietnam, for example, farmers are used to farming via traditional methods to meet their daily needs and would not see the need to learn and adopt low-carbon technologies, said Mr.Pham.

To meet these challenges, regional cooperation is necessary, as well as more innovation in both technologies and financing instruments, said Mr. Yongping Zhai, Technical Advisor, ADB. He and Mr. Anbumozhi believed that south-south cooperation will aid technology transfers through learning and collaboration.

Roundtable C

The Future Electricity Grid – Challenges and Opportunities. The major discussion points of this round-table hosted by Grattan Institute were as under:

Intermittent energy supply is creating real challenges for traditional energy market models, said Tony Wood, Energy Programme Director, Grattan Institute.

The energy sector needs to prepare itself as changes are bound to come. "Regulators need to keep up with change," said Mr. Arthur Hanna, Senior Advisor to the CEO of the World Energy Council. Mr. Hanna cautioned that as we try to understand the challenges, we need to look into history and legacy, and consider issues unique to the local context.

Dr Alvin Yeo, Director of Industry Development, Energy Market Authority (EMA), said that nimble government policies are important for the integration of new business models. Infrastructure changes could also be needed to enable new technologies.

There will still be a role for wholesale, retail and ancillary markets in the future. The question is how the industry can set the right pricing signals and provide transparency and predictability to investors. Mr. Hanna shared that Denmark is building capabilities in data analytics for instance in the area of demand forecasting which could help to shed some light.

The other part of the equation is what it really means for consumers on the demand side. Increasingly, security of supply becomes imperative for governments and the network operators. Should consumers prefer the use of clean renewables, or energy storage solutions, the industry must be able to meet such demands. The panel discussed how the electricity network may not be able to avoid "Uber-ising".

Mr. Yeo said "Singapore is giving a greater push to demand side management solutions" and underlined the importance of consumer education and awareness through clear and simple communication. Mr. Alistair Parker, Executive General Manager, Regulated Energy Services of AusNet Services added that it would not be easy given the short time consumers spend thinking about such issues.

Roundtable D

Renewable Energy Roadmap Outlook for ASEAN – a REmap Analysis major discussion points of this

Experts during the Roundtable discussion at SIEW 2016

Experts during the Roundtable discussion at SIEW 2016

round-table hosted by International Renewable Energy Agency (IRENA) were as under:

Achieving a 23 per cent share of renewables in ASEAN's primary energy supply by 2025 requires a concerted effort from its member states, said panellists during the roundtable.

A diverse approach to advancing renewables in ASEAN must be adopted, given the region's significant heterogeneity which limits the benefits of regional knowledge exchange, said Ms. Maria-Jose Poddey, Principal Adviser, Renewable Energy Support Programme for ASEAN (ASEAN-RESP) GIZ.

Renewables are already cost-competitive – and are even more so when savings generated by reduced externalities from increased use of renewables are factored in, said Mr. Sakari Oksanen, Deputy Director-General, IRENA. To achieve the 23 per cent target mobilising finance to double the investment in renewables is key he added.

Building an enabling environment for this is therefore necessary. Dr Sanjayan Velautham, Executive Director, ACE, shared how appropriate feed-in tariffs, simplified permit procedures, attractive incentives, and financing support mechanisms can be policy tools to encourage the growth of renewables.

With the emergence of prosumers, enhancing the regulatory framework to accommodate new business models in renewable energy is also important, said Eugene Toh, Director (Policy), Energy Planning and Development Division, Energy Market Authority (EMA), Singapore.

Dr Karnnalin Theerarattanannon, Engineer, Energy Research Bureau, Department of Alternative Energy Development and Efficiency, Ministry of Energy, Thailand, added that using a hybrid of dispatchable and non-dispatchable renewable energy is also another means of helping ASEAN reach its renewable energy target.

That said, the panel agreed that regional cooperation, as well as stable, transparent and consistent policy, are still essential to ensuring concrete action on the variety of measures discussed, that will help ASEAN achieve its renewable goal.

Roundtable E

Power Sector Integration in Southeast Asia. The major discussion points of this round-table hosted by International Energy Agency (IEA) were as under:

"Regional integration can help balance the energy trilemma" said Mr. Matthew Wittenstein, Electricity Sector Analyst, International Energy Agency (IEA).

With electricity demand in Southeast Asia projected to triple by 2040, ASEAN need to find innovative solutions to fuel their economies. Through regional collaboration and interconnection, panellists agreed that ASEAN can meet their power sector needs in a more affordable, secure and sustainable manner. "An interconnected grid enables better leveraging of regional resources to meet domestic demand growths" Mr. Wittenstein said.

In particular, an interconnected power system can enhance the development and integration of variable renewable power generation sources, enabling the decarbonisation of ASEAN economies. For example, countries could potentially draw cheaper and cleaner hydropower from Laos and Myanmar through collaborative projects. Dr Phyllis Yoshida, a Fellow for Energy & Technology from the Sasakawa Peace Foundation, added that interconnectivity could potentially improve the overall resiliency of ASEAN through the provision of mutual grid support.

However, panellists agreed that progress on developing a unified power grid in Southeast Asia has been somewhat limited.

Mr. Beni Suryadi, Senior Research Analyst from the ASEAN Centre for Energy (ACE), said that many issues still needed to be addressed. These ranged from geophysical constraints to differences in regulatory and market structures to geopolitics.

Nonetheless, countries are already working together to address these issues, with panellists expressing hope of a unified grid in Southeast Asia within the next decade.

Effective regulations and equitable cost sharing mechanism are key as these provided the long-term

certainty required by investors for grid interconnection projects, said Mr. Wittenstein. Additionally, regulators will also need to learn to take on responsibilities at both the national and regional levels to harmonise regulations and reliability standards among different power grids.

Roundtable F

ASEAN-China Energy Security and Connectivity. The major discussion points of this round-table hosted by Chinese Academy of Social Sciences (CASS) & Institute for the Analysis of Global Security (IAGS) were as under:

Against the backdrop of a slowing Chinese economy and evolving political relationships between China and Southeast Asian countries, panellists during the roundtable explored how China's One Belt One Road (OBOR) initiative could contribute to future developments in - and increase engagement with – Southeast Asia.

Over the years, China has shifted from being the world's largest factory, importing energy and raw materials to feed commercial and industrial production, to becoming the largest consumer market in the world. Factories are moving from China to countries such as Vietnam and Bangladesh. This is causing industrial production in China to slow down.

"The unchanging is changing", said Dr Liu Qiang, Secretary-General of the Global Forum on Energy Security. However, China continues to maintain an interest and willingness to explore investments overseas. There lie the opportunities for Southeast Asia.

The region's economic growth is projected at 4-6 per cent and its energy demand is expected to double in the next 25 years. As a result, these countries will need to invest heavily to modernise energy systems and increase access to energy at an affordable price.

"The IEA estimates that over the next 25 years, countries in Southeast Asia will need US$2.8 trillion in investments in energy. That is $100 billion a year," said Dr Philip Andrews-Speed, Senior Principal Fellow at the Energy Studies Institute (ESI), National University of Singapore.

Dr Kaho Yu from the Harvard University Kennedy School identified four aspects of possible collaboration between China and Southeast Asian countries – infrastructure construction, industry integration, financing, and multilateral governance.

Nevertheless, there remain challenges on both sides. While Chinese financing instruments such as the Asian Infrastructure Investment Bank offer relatively attractive terms compared to western development banks, there is limited financial capacity. The current regulatory framework and governance structure in Southeast Asian countries are not helpful either, making it difficult for investors to get projects going.

Wrapping up the roundtable discussion, Dr Liu said that while the Chinese government and companies were willing to invest, Southeast Asian countries and local leaders were equally responsible to pave the way for these investments. What was clear was there needs to be an alignment of expectations on both sides to maximise mutual benefits.

Roundtable G

Nuclear Safety and Cooperation in ASEAN. The major discussion points of this round-table hosted by S. Rajaratnam School of International Studies (RSIS) were as under:

Ensuring nuclear safety is the responsibility of all countries, said experts during this roundtable.

Dr Tatsujiro Suzuki, Vice Director of the Research Center for Nuclear Weapons Abolition (RECNA) at Nagasaki University, said that countries in a region should work together to share information and develop solutions for the region – noting that effects from the Fukushima accident was still present both on-site and off-site after five years. This was in view of ASEAN's increasing interest in nuclear energy, with a number of newcomer countries having no prior experience in operating nuclear power plants.

Among them, Vietnam is taking the driver's seat with clear plans to build nuclear power plants, said Dr Hoang Sy Than, Deputy Director of the Department of Planning and R&D Management at the Vietnam Atomic Energy Institute (VINATOM). Vietnam is also

The region's economic growth is projected at 4-6% and its energy demand is expected to double in the next 25 years. The IEA estimates that over the next 25 years, countries in Southeast Asia will need US$2.8 trillion in investments in energy

Experts during the Roundtable discussion at SIEW 2016

taking active steps to promote regional and international cooperation. The country's first nuclear power plant in the Ninh Thuan province is expected to be ready for operation in 2028/2029.

Within ASEAN, nuclear safety and regional cooperation remain key priorities. Platforms, such as the ASEAN Nuclear Energy Cooperation Sub-Sector Network (NEC-SSN) and ASEAN Network of Regulatory Bodies on Atomic Energy (ASEANTOM), have been set up to facilitate discussion on nuclear issues between leaders and regulators of ASEAN member states.

One such issue is on public acceptance. Suzuki said that restoring public trust in nuclear after Fukushima has been a major challenge for the Japanese government – with a poll indicating that 70 per cent of respondents did not support the re-start of existing nuclear power plants.

Transparency, clarity and accuracy in communicating with the public and conveying information is crucial, said the panellists in response to questions on what was being done by the respective countries to assure the public on the safety of nuclear power plants.

Citing data from the Paul-Scherer Institute on deaths per unit of electricity generated, Shah Nawaz Ahmad, Senior Advisor, India, Middle East and South East Asia, World Nuclear Association (WNA), said that nuclear energy is by far the safest form of electricity generation.

Mr Ngai Chee Ban, Operations Leader Asia Pacific, Honeywell Industrial Cyber Security

Roundtable H

Smart Multi Energy Systems – Challenges and Opportunities. The major discussion points of this round-table hosted by Energy Research Institute @ NTU (ERI@N) were as under:

Emerging information and communication technologies (ICT) are providing opportunities to integrate disparate energy systems and allowing industry to monetise their assets through optimisation, said Dr Sanjay Chittaranjan Kuttan, Program Director of the Energy Research Institute @ NTU (ERI@N), during this roundtable.

Buildings are one key area where integration and optimisation of energy systems provide huge potential in energy savings, said Mr. Jimmy Khoo, Managing Director of Singapore District Cooling. Air-conditioning contributes to more than 50 per cent of the energy consumption in office building in Singapore, explained Mr. Keiichi Katajiama, Senior Researcher at Hitachi, as he demonstrated that potentially 5 per cent of this energy can be saved during the rainy seasons, using simulation-based optimisation technology on chiller plants.

Data is a huge enabler in energy efficiency in buildings through monitoring, control and optimisation of energy systems, said Mr. Rohan Rawte, Head of Asia Operation at IESVE. He shared a case study on six selected buildings in Glasgow City where estimated energy savings of $450,000 can be achieved by using advanced data analytics to identify areas where energy efficiency can be improved.

Machine learning in particular can be deployed in many areas to better value extraction, said Mr. Henrik Bache, Managing Director of eSmart Systems in Asia. Besides load forecasting, using machine learning to predict grid outages could be increasingly important in the future when the integration of renewables present higher risk of such occurrences.

That said, mining insights from data can be challenging, said the panellists. One of the key challenges is accessing and storing quality data in the right format. Many valuable data is currently generated outside of current legacy data systems which are

unable to handle the huge volume of data, the panellists added.

Data must be presented in an easily understood manner to ensure all stakeholders in the value chain are able to understand where the bottleneck is, and be able to take action to save energy in an effective way. Ted Chen, co-founder and Chief Product Architect at Evercomm, emphasised that the process to achieve this is not straightforward and end users should be educated to progress step by step to drive actions.

Roundtable I

Cyber security Strategies in Power Generations – Defence or Resilience? The major discussion points of this round-table hosted by Energy Studies Institute (ESI) were as under:

As cyber security threats increase in sophistication and reach, the power generation sector needs to increase its resilience against cyber-attacks, and enhance its cyber defence capabilities, said Dr Philip Andrews-Speed, Senior Principal Fellow, Energy Studies Institute, National University of Singapore (NUS).

Global power systems are undergoing a transformation, and new trends such as the increasing use of renewables and the integration of power systems across borders are coming into play. These lead to critical issues and challenges for information systems, said Mr. Matthew Wittenstein, Electricity Sector Analyst, Gas, Coal and Power Markets Division, International Energy Agency (IEA).

Many people see cyber security as a technology problem, but what really underscores the defence and resilience of the whole ecosystem was intelligent human management. “There is no such thing as 100% cyber protection,” said Mr Ngai Chee Ban, Operations Leader Asia Pacific, Honeywell Industrial Cyber Security. “It is about how much you protect your ground. If you are putting on a good fight, there is no reason for them [hackers] to continue fighting with you.”

Mr Ngai spoke further about the defence and resilience strategies that the power sector need be aware of to counter cyber security risks. “Increasingly, industrial control operators are departing more and more from the legacy technologies that they are using. With the increasing requirements of the demand and supply chain on distributors and power sector producers, there is demand for them to connect to the world”.

Mr Akhlesh Kaushiva, Programme Manager, Department of Energy, United States, spoke on the US perspective on cyber security in the power and electricity sector, and explained that power systems are now expected to operate 24/7, with high reliability and availability. “The energy delivery control system must be able to survive a cyber security incident while sustaining critical functions. Real time operations are imperative, also real-time emergency response capability is mandatory.”

Mr Kaushiva shared that if there are near real-time variables impacting the operations of a power system, power operators would need tools that are faster than real time. The US has ongoing research and development in faster than real-time modeling and new tools to tackle these issues.

Mr Lim Thian Chin, Deputy Director and Head of CII Protection, Critical Information Infrastructure Division at the Cyber Security Agency

of Singapore and Dr Madan Oberoi, Director of Cyber crime at the Interpol Global Complex for Innovation joined the speakers for the panel discussion. The panel acknowledged that cyber security was a present and real threat to society, and agreed that multi-stakeholder collaboration for the private and public sector, through learning and sharing of information in global sharing platforms, was vital for the power sector to continue improving its capabilities in cyber security.

GAS ASIA SUMMIT 2016 (GAS 2016)

Gas Asia Summit & Exhibition 2016 (GAS 2016) encompassed both commercial and technical aspects of the gas and LNG value chain. GAS 2016 delivered the only dedicated event for industry professionals from across the natural gas and LNG industry and its related sectors within the Singapore International Energy Week 2016 (SIEW 2016). The event also focused on Japan, South Korea, China and Indonesia through special sessions.

Sharing his thoughts during opening of the Gas Asia Summit 2016 Mr S. Iswaran, Minister for Trade and Industry (Industry), Singapore highlighted the global gas market outlook and implications, emerging trends, as well as developments in the Singapore gas market.

The guest of honour Dr Rashid Allem, Chairman, Sharjah Electricity & Water Authority (SEWA), Government of Sharjah and Amos J. Hochstein, Special Envoy and Coordinator for International Energy Affairs, Bureau of Energy Resources, U.S. Department of State delivered keynote addresses at the Summit. Both speakers spoke on how LNG is being used as an energy resource by more economies and the need for the industry to be sustainable and environmentally-friendly, as well as

LNG is the buzzword now because of the fluctuating oil prices globally. We feel more and more economies will start to use LNG as an energy resource due to growing need for the industry to be sustainable and environmentally-friendly: Dr Rashid Allem

'Asian gas market will remain soft

The global economic outlook remains uncertain, on the back of China's slowdown and volatile financial markets. More recently, the European Central Bank and the International Monetary Fund noted that Brexit will further exacerbate global uncertainty, with its full economic impact yet to be felt.

The global gas market has been affected by this weak and uncertain global economic outlook. With Asia accounting for more than seventy per cent of global LNG demand, the LNG market has seen weaker than expected demand from buyers in China, Japan and Korea. At the same time, Australia and the US are set to supply close to 140 Mtpa of LNG over the next five years, which will increase global LNG supply by over fifty percent. These demand and supply-side factors have led many analysts to believe that the Asian gas market will remain soft till the end of the decade.

Long Term Implications

The uncertain global outlook, coupled with excess gas supply and the attendant low gas prices, holds far-reaching implications for the longer-term energy landscape.

There is the prospect of diminishing investments as investors reduce their exposure to the energy sector by scaling-back capital injections. This is exacerbated by rising financing costs in a market of uncertainty as lenders expect higher risk premiums.

Furthermore, producers who strive to cut costs may limit upstream E&P activities, which will lead to

Dr Rashid Allem, Chairman, Sharjah Electricity & Water Authority (SEWA), Government of Sharjah

till the end of the decade'

The global gas market has been affected by weak and uncertain global economic outlook. These demand and supply-side factors have led many analysts to believe that the Asian gas market will remain soft till the end of the decade, says Mr S Iswaran, Minister for Trade & Industry (Industry), Singapore during his opening remarks at Gas Asia Summit at SIEW 2016

a reduction in the availability and accessibility of supplies in the longer term. The industry needs to re-establish a healthy equilibrium; if not, sustained under-investment will have adverse long-term consequences on energy security and pricing.

Emerging Trends

Pricing and contractual trends have continued to evolve along with changing market dynamics. Most Asian gas contracts have traditionally been linked to oil prices which do not necessarily reflect gas demand and supply fundamentals. While depressed oil prices have reduced the incentive for gas buyers to push for an alternate pricing mechanism at present, there remains the need for a price marker that better reflects the cost of gas to create win-win outcomes for buyers and sellers in the longer term.

Buyers are actively negotiating for price review mechanisms to ensure price competitiveness over the tenure of their gas contracts. They are also increasingly reluctant to lock themselves into large-volume long-term contracts, favouring deals that offer flexibility in contract durations, volumes, and destinations.

From the sellers' perspective, it is also in their interest to have prices that reflect the fundamentals of gas demand and supply. They have been open to offering shorter term contracts for surplus supply under their existing portfolios. However, it is still important for sellers to have a base-load of long-term contracts to underpin investment decisions for new liquefaction projects.

Singapore's Gas Market Developments

Against this backdrop, it is important for a small country like Singapore, which is highly dependent on gas imports, to stay nimble and adaptable to emerging trends and changing global developments.

To this end, Singapore has embarked on a series of policy initiatives to move towards a more dynamic gas market.

For example, we introduced the Competitive Licensing Framework in 2014 to allow Singapore to

Mr. Amos J. Hochstein, Special Envoy and Coordinator for International Energy Affairs, Bureau of Energy Resources, U.S. Department of State

current market supply and demand trends and its correlation to infrastructure. They outlined the importance of energy sustainability and conservation and provided an insight into energy relations between the US and Asia in the coming years respectively.

"LNG is the buzzword now. Because of the fluctuating oil prices globally, we feel more and more economies will start to use LNG as an energy resource," said Dr Alleem, while emphasising the need for the industry to be sustainable and environmentally-friendly.

The first plenary during the Summit focused on "The regional market outlook for Asia: Future forecasts for gas and LNG". The session was addressed by Mr.Masakazu Toyoda, The Institute of Energy Economics, Japan (IEEJ) Chairman & CEO; Ms.Mina Sekiguchi, KPMG Japan and KPMG Asia-Pacific

Managing Director, Head of Energy & Infrastructure and Head of Energy & Natural Resources; Mr. Adrian Lunt, Singapore Exchange (SGX), Head of Commodities Research and Mr. Toby Balch, Nova Scotia Department of Energy, Director, Business and Technology.

The areas covered in the first plenary were:

- Opportunities for developing regional gas market to take advantage of increasing market supplies and new trade routes
- Is the Asian market mature enough for small-mid scale LNG?
- North America unconventional gas and the changing fundamentals and dynamics in LNG trade
- Where is Asia's gas potentials and why it is important to have a clear map moving forward
- Spot markets and expiring long-term contracts – what's the next step
- Future of gas in the energy mix in comparison with other fuels for energy security
- Global LNG demand and supply dynamics
- The challenges to commoditization in LNG
- Nova Scotia's key strengths for LNG export in Asia

The second plenary was on "Bridging the gap between large and small scale LNG players" was addressed by Mr.Theo Lekatompessy, President, PT Humpuss Intermoda Transportasi; Mr.Saurabh Mishra, Senior Engineer, GAIL (India) Limited; Mr.Ron Heffron, Vice President, Moffatt & Nichol; Mr.Saunak Rai, VP Operations & LNG Business Development,Norgas Carriers Private Limited; Mr.Vivek Chandra, CEO and Founder, Texas LNG.

The areas covered in the second plenary were:

- Breaking down the barriers of large and small-mid scale LNG markets – how to ensure smaller markets are attractive to large scale producers
- What is it going to take to break bulk into smaller markets?

Opening Plenary of Gas Asia Summit 2016 during SIEW 2016

take advantage of prevailing market trends by procuring LNG imports on a tranche-by-tranche basis.

As announced that Pavilion Gas and Shell have been appointed as the term importers for Singapore's next tranche of LNG.

The commencement of the new tranche of LNG imports will provide us with access to the appointed importers' global LNG supply portfolios, which include gas from the U.S., Australia, Norway, Russia, Qatar and Brunei. This diversity of supply will further strengthen our energy security.

The two appointed importers also offer gas buyers more flexibility through options for shorter contract durations and alternative pricing indices to oil indexation.

Together with the commencement of the new tranche of LNG imports in 2017, we will allow the import of third-party spot LNG as well as new PNG supplies on a case-by-case basis. These policies will increase the gas supply and pricing options available for buyers in Singapore.

For the import of spot LNG, EMA had earlier suggested allowing buyers to contract up to 10% of their gas demand as spot LNG. The industry has provided feedback that it would be better to allow spot imports on a first-come-first-serve basis, subject to a market-wide cap, to provide greater flexibility for buyers. EMA is reviewing the detailed feedback and will consult the industry later this quarter on how to operationalise the spot LNG import policy.

EMA is also developing a domestic Secondary

- What is the requirement and decision making process to bridge large-small scale distribution?
- How small-mid scale players can send the right signals to secure supply?
- Understanding the commercial difference between small and large scale contracts
- A GAIL case-study on bridging the gap between large and small scale LNG players?
- Lowering costs and surviving extreme events for near shore FLNG/FSRU terminals?
- Breaking Bulk: The SSLNG Way?
- The rapid evolution of the International LNG trade: Changing Players, Changing Structures, Changing Strategies

The third plenary during the Gas Asia

Gas Trading Market (SGTM). The SGTM will provide more flexibility for gas buyers to manage their portfolios and encourage better price discovery. This will provide gas buyers more options to manage uncertainty. We have completed the first phase of detailing a roadmap to implement an SGTM. An industry working group, which will deliberate the details leading to the initiation of the SGTM, will commence discussions early next year.

In the area of infrastructure development, the current 6 Mtpa throughput capacity of the LNG terminal on Jurong Island will increase to 11 Mtpa by early 2017. A fourth LNG storage tank will also be completed in 2018. The expansion will allow the terminal to better cater to different demands, in addition to domestic throughput services. We are also studying options to enhance our energy security through the potential development of a second LNG terminal.

Development of Trading and Ancillary Services

Beyond meeting domestic needs, our LNG infrastructure is capable of supporting ancillary activities.

Last year, Trafigura signed a term agreement with SLNG to utilise its spare capacity for Storage and Reload activities. To date, Trafigura has conducted a number of unloads and reloads at the terminal, making use of the terminal's ability to carry out break-bulk operations.

Singapore is also developing its LNG bunkering sector. The Maritime and Port Authority of Singapore (MPA) appointed two LNG bunker suppliers earlier this year – Pavilion Gas, and a joint venture between Keppel Offshore & Marine and Shell. They will commence LNG bunkering services in Singapore in the first quarter of 2017, after SLNG completes constructing an LNG truck loading facility.

Singapore will continue to foster a dynamic LNG ecosystem which includes supporting industry-led initiatives to facilitate price discovery and the development of a LNG trading hub in Singapore.

In this regard, the Singapore Exchange (SGX) has launched the Singapore SLiNG as well as the North Asia SLiNG as alternate gas price markers for the Asian market. SGX has also announced plans to launch more LNG financial derivatives next year based on these markers. Buyers, sellers and traders in the region can look forward to these exciting developments in Singapore.

These developments will increase the vibrancy of the Singapore gas market, and grow its regional footprint. We hope to see continued interest from companies to utilise these ancillary services and to establish their LNG trading presence in Singapore.

With ever-changing dynamics in the global gas market, policy-makers, buyers and sellers must work together and be open to explore innovative solutions to achieve the long-term sustainability of the gas industry. The Gas Asia Summit provides a good opportunity for industry experts to exchange views on the gas market, and consider how we can collectively address the challenges and opportunities in the current market environment.

Summit focused on "New horizons for gas in a low-carbon post COP 21 world". The session was addressed by Mr.Lukman Mahfoedz, President Director,Medco Power Generation Indonesia, PT; Mr. Kari Punnonen, Area Business Development Manager, MEA, Wärtsilä Corporation; Mr.Sanjay Verma, Director - Business Development, SEA, Wärtsilä Marine Solutions; Mr. Umar Jahangir, General Manager, Pakistan LNG Terminals Limited.

The areas covered in the third plenary were:

- World gas resources availability and sustainability – role of regulators and industry players
- Renewables and LPG a threat to gas as a primary fuel with the global volatile oil prices?
- Increasing gas usage through unconventional resources
- Gas compared to other fuels on cost, availability, volumes and power generation – Envisioning a 100% gas-fuelled Asian future
- Regional regulation and policies to increase gas usage and impact on markets
- LNG to power, an overview of the gas business
- Pakistan's future course on energy and how dependent it is on gas rather than other fossil fuels

The fourth plenary on "Trading, origination and pricing updates: LNG as the new global commodity?" was addressed by Mr. David Morris, Lead LNG Originator, Asia, Uniper Global Commodities; Mr. Denis Bonhomme, Senior Vice President Business Development Asia, ENGIE Global LNG; Ms.Kerry Anne Shanks, Head of Gas and LNG Research, Asia Pacific, Wood Mackenzie; Mr. Gardner Walkup, Managing Director, Berkeley Research Group, LLC and Ms. Lily Chia, Head of Oil, Power & Gas for Derivatives,

Singapore Exchange (SGX).

The areas covered in the fourth plenary were:

- Oil pricing patterns and impact to global gas and LNG pricing and usage
- Role of North America in comparison with other emerging suppliers on price
- Ambitions for Asian 'hubs' – Tokyo, Shanghai, Hong Kong & Singapore?
- New trading patterns and the demand for flexibility from Asia's large buyers
- What is the gas pricing strategy and methodology of Japan and South Korea?
- Comparison of natural gas pricing index – what is more attractive in the market today - US Henry Hub, JCC or cocktail price
- Impact of Panama Canal expansion that provides easier access for Atlantic Basin cargoes to a higher priced LNG market in Asia
- How US LNG will impact European LNG markets and the related consequences on global LNG markets in the coming years
- Shale 2.0: The Impact on the Market Outlook for Asia
- Pricing – the ultimate arbiter of demand and supply

The fifth plenary on "Raising capital and delivering gas & LNG projects in tight economic times" was addressed by Mr. Nobuyuki Higashi, Vice President, Corporate Strategy & Planning Division, INPEX Corporation; Mr.Syed Ammar Shah, Head of Business Development, Engro Elengy Terminal (Pvt) Limited; Mr. Mangesh Patankar, Head of Business Development - Asia Pacific, Galway Group; Mr.Luigi Corleto, Principal, Energy & Utilities practice, Bain & Company; Mr. Paolo Zamberletti, Partner, K&L Gates LLP.

The areas covered in the fifth plenary were:

- What and where are the opportunities for infrastructure development in Asia?
- Making projects Bankable: Attracting, retaining foreign investors for gas & LNG developments
- Doing Business in Asia: Commercial barriers to entry – what are they and what needs to change
- Why investing in digital technologies is important for your business – case study
- Reshaping Energy Landscape of Pakistan - Challenges & Opportunities
- Can we find new financing schemes for LNG projects under the LNG market evolution in Asia-Pacific including the expansion of flexible, shout-term or destination-free trade?
- What is the key for enhancing "Domestic Gas Value Chain" in Emerging Asia countries?
- What is the possible collaboration between Japanese investors/lenders and Asian partners?
- A wave of gas price review in the APAC region? Possible impact and lesson learned from European experience – A joint presentation by Bain & Company and K&L Gates.

Country focus: Japan

During the country focus session, Japan touched upon the following changes in its energy market structure and addressed the under-mentioned issues:

- Post-Fukushima – what fuel emerges dominant for power generation and factors affecting this decision?
- What are the changes in Japan's market structure with emphasis on future power and gas liberalization?
- Updates on Japan energy market reformation and deregulation – how has this affected the demand for gas and LNG
- Distributed power – to what extend will it be pipeline gas/LNG/renewables/nuclear?
- The liberalisation in Japan: a recipe for international disputes
- Shipping aspects – New Factors for estimating future LNG Vessel Demand in Japan

The Japan session also touched upon pricing mechanism in there compared to other markets and addressed the under-mentioned issues:

- How has Japan cope with the falling oil prices on spot and long-term LNG purchase – pricing mechanism in comparison with other markets?
- Tackling oil price mechanism for wholesale practice
- Updates on Japan's Joint Crediting Mechanism (JCM)
- LNG pricing differences between the Atlantic and Pacific basin - current and projections
- Spot benchmarks - Japan Korea Marker (JKM) versus Britain's National Balancing Point (NBP)
- China, Japan or Singapore? Where is the future Asia-Pacific LNG hub located?

The Japan session was addressed by Mr. Kazuhiro Yokoi, Senior Vice President Fuel Transactions Group, JERA Co., Inc.; Mr.Nobuhisa Kobayashi, Managing Director,Tokyo Gas Asia Pte Ltd.; Mr.Edward van Geuns, De Brauw Blackstone Westbroek; Mr.Tatsuo Masuda, Visiting Professor, Graduate School, Nagoya University of Commerce

and Business (NUCB); Mr.Tatsuro Watanabe, General Manager, Energy Business Strategy Office, Energy Transport Business Unit, Mitsui O.S.K. Lines, Ltd.; Ms.Mina Sekiguchi, Managing Director, Head of Energy & Infrastructure and Head of Energy & Natural Resources, KPMG Japan and KPMG Asia Pacific; Mr.Naoki Tatsumi, Director, KPMG Japan and Mr.Brian Busch, Director Oil Markets & Business Development,Genscape.

Experts at the country focus session of Japan

Country focus: South Korea

In the country focus on South Korea, the under-mentioned areas were covered and was addressed by Mr.Odin Kwon, Head of Basic Design Team 1 / DSME Vice President,Daewoo Shipbuilding & Marine Engineering Co, Ltd (DSME) and Mr. Brandon Shin, General Manager, Gas Entec Co. Ltd.

- Pricing strategy – methodology from South Korea
- Case study – LNG Engineering solutions for large to small scale ships/carriers
- Risk assessment of offshore LNG bunkering terminal
- Gas and LNG market outlook in South Korea with falling oil prices – projections of demands and supply
- Updates on South Korea's global participation in LNG projects in SEA and Middle East
- LNG as a marine fuel – a South Korean case study
- Challenge to the niche market

A Project Showcase was also held on the "World's First: Official launch of South Korean LNG-Fuelled Bulker Carrier." The collaborative effort by nine Korean companies saw new technology of LNG storage material being showcased.

Country focus: China

The China country focus touched upon the following areas and was addressed by Mr.Jun Bai, Deputy Director, Institute of International Energy, International Cooperation Center, National Development and Reform Commission and Mr.Peter Hansen, Chief Executive Officer,Blue Sage LNG.

- How much LNG is China likely to import by 2030 and who is going to use it?
- What China producers and end-users need to know about the LNG sector today?
- Evaluating the most reliable and economical long-term gas supply options for China – Accessing stranded gas assets via small-mid scale LNG opportunities or buying LNG off spot markets
- Centralization versus decentralization for the energy sector
- China's success story in small to mid-scale LNG distribution
- The impact of China's energy policies, regulatory changes and government thinking on the gas market in China and the world at large

Country focus: Indonesia

The country focus on Indonesia touched upon the following areas and was addressed by Mr.Robert Johnson, Senior Vice President Natural Resources, Project Finance, Structured Finance Department, Asian Investment Banking Division, Bank of Tokyo-Mitsubishi UFJ, Ltd.; Mr.Djohardi Angga Kusumah, Senior Vice President Gas & Power, Pertamina (Persero), PT; Mr.Sampe L. Purba, Vice President of Gas Commercialization, SKK Migas and Mr.Avinash Panjabi, Senior Associate (Indonesia), Ashurst LLP

- Updates on PLN supply chain tenders – who, what and when?
- Indonesian gas regulation and legislative framework updates
- The future of gas in a coal dominated market. What are Indonesia's commitments to move away from coal to gas?


Experts at the country focus session of China

Gas Asia Summit 2016 session in progress

- Who are the regional drivers for small-mid scale LNG developments and map of opportunities in Indonesia?
- Balancing gas export with import for domestic power generation – understanding priorities for infrastructure investments
- New gas supply market to meet Indonesia's domestic needs for power generation
- Recent Regulatory Initiatives to Support Indonesia's Domestic Gas Market.

The technical session on "Gas & LNG Distribution and Technology" discussed the following:

- What are the types of technology to effectively build distribution?
- How to turn LNG to an energy distribution network like what we see for gasoline?
- What are the technological breakthrough that will reduce the cost of distribution – what vessel, what design and what approach?
- Ways to drive down cost through cheaper manufacturing
- Different technologies available for FSRU, FLNG and Floating Power for redistribution
- Case studies for successful applications of small to mid-scale technologies
- Levelised cost of technology for a levelised cost of electricity
- Design aspect of small-scale LNG and bunkering vessels with related technology
- Strategic Gas Planning via Performance forecasting studies
- Effective integration of super compact BOG re-condenser into LNG receiving and regasification terminals
- How to customize small and mid-scale LNG infrastructure to meet the growing market in the ASEAN region

Technical Session

The technical session on "Operations of Small-Scale Producers Accessing Large-Scale Markets and Vice Versa" discussed the following:

- What operational aspects need to be considered for large scale producers going into the smaller markets?
- What needs to happen for large to small scale LNG distribution?
- Bringing down cost for FLNG projects and encouraging small scale LNG – case study
- Break-bulk offloading operations for smaller-scale shipments and offloading operations for FLNG
- FLNG: Costs and cost drivers
- Democratizing LNG: Why flexible solutions and new applications across the LNG supply chain are maximizing LNG market potential for an increasing number of smaller players

The technical session on "Extending Life of LNG Facilities" discussed the following:

- Ways to get more out of existing onshore and offshore facilities and expanding life span of plants
- Redevelopment and enhancements of brown fields
- Areas to consider to revitalise existing assets
- Expansion and upgrades of existing LNG assets for increased operations and output – a case study
- What are the maintenance practices and policies to extend the life span of a matured asset?
- Operational Excellence - Best Practices in Pipe line Management: design, Inspection, Remaining Life Assessment & Online Repair

Q&A at a technical session during Gas Asia Summit 2016

The technical session on "Large to

Small Scale Offshore and Deepwater Gas and LNG Developments and Technologies" discussed the following:

- Applications and engineering solutions for small to large scale plants
- Ways to reduce cost of small scale LNG developments through technology, size and vessel type
- The development process and the key stakeholders
- Construction risk and how to mitigate
- National development opportunities
- Large to Mid-Small Scale LNG Plant - Technologies for Offshore Application
- Successful development of offshore LNG projects
- World's First LNG-Powered Bulk Carrier with New Technology of LNG Storage

The technical session on "Process and Plant Design Optimisation" discussed the following:

- Liquefaction process suitable for offshore facilities
- Optimizing small-scale LNG Plant
- Modelling and optimising of LNG process-case study
- Improving energy consumption and overall efficiency of LNG plants
- Improving operational efficiency through digital technologies – big data, Industrial Internet of Things (IIoT)
- Flexible integrated NGL/LNG Plant for unconventional gas
- Recognising human factor as a key element in managing process safety
- Asset Integrity - Pressure Relieving Devices
- A Challenge Project in the Middle East
- Accurate determination of settle-out pressure for centrifugal application

All the technical sessions were addressed by industry experts and leaders of their respective fields.

Expert Talks

The Summit also witnessed exclusive talks by Mr.Derek Thomas, Head - Advanced R&D Unit, AG&P on "One-stop shop solutions" which touched upon the benefits of an integrated approach to maximizing LNG market potential in Southeast Asia.

Other talks were by Mr.Stephane Maillard, General Manager, Gaztransport & Technigaz – GTTSEA Pte Ltd on "Small-scale LNG chain optimization". The talk focused on the technical and commercial advantages of membrane technologies for onshore and offshore storage.

The talk by Mr.Brandon Shin, General Manager, Gas Entec Co. Ltd focused on LNG design innovation and integrating sub-components such as cargo handling and control systems for various small and mid-scale LNG vessels, while Mr.James Hermary, Project Leader Development LNG, Trelleborg Fluid Handling Solutions touched upon flexible LNG transfer and how Cryoline hose-in-hose transfer systems for LNG are increasing accessibility, optimizing safe transfer and significantly lowering operator and supplier costs.

In his talk Mr.Ron Heffron, Vice President,Moffatt & Nichol touched upon innovative and cost effective terminal solutions that reduces and simplifies terminal, mooring and LNG transfer infrastructure for smaller markets.

Technical Workshops

The Summit also witnessed technical workshops conducted by experts from AG&P and Ashurst LLP.

The workshop by AG&P discussed democratizing LNG in South East Asia: Lowering the cost of small and mid-scale LNG distribution within the ASEAN region. It focused on how the flexible solutions that are being designed specifically for Southeast Asia – the world's fastest growing LNG region – and the latest LNG applications that are being developed to maximize market potential. Expert speakers will explain the technical design and scaling of infrastructure and systems and the environmental, operational and safety standards that will enable successful transition from a small number of large operators to a much larger number of smaller ones

A display of state-of-the-art LNG vessel model by AG&P during Gas Asia Summit 2016 exhibition

The workshop by Ashurst LLP discussed developing LNG to Power Projects in South East Asia. It focused on South East Asian power developers and governments are increasingly looking to LNG as an alternative to coal, piped natural gas and other fuel sources. Establishing regasified LNG value chains brings both unique opportunities and challenges for all stakeholders, particularly given the current state of the global LNG market.

Bilateral Cooperation

SIEW 2016 also witnessed the Energy Market Authority (EMA) and the Sharjah Electricity and Water Authority (SEWA) signing a MOU to strengthen bilateral cooperation in the energy sector.

The MOU will establish a platform for energy cooperation and information exchange. This includes areas such as the promotion of efficient energy markets, the sustainable development of electricity and gas industries, and best practices in manpower development. The MOU will also facilitate private sector collaborations in the energy sector. It ties in closely with Singapore's collaboration with the UAE in sectors related to energy, water and the Internet of Things.

Mr Ng Wai Choong, Chief Executive of EMA, said "We share common interests in developing our energy sectors". "I look forward to strengthening our ties with Sharjah through deepened collaboration with SEWA."

Dr Rashid Al Leem added that "the signing of this MOU between EMA and SEWA is another milestone for Sharjah and in the larger sense, the UAE. It builds upon the excellent spirit of cooperation and relationship we have with Singapore. The outcome would surely be sustainable development in the field of clean energy, as well as the pursuit of best practices".

The Summit was attended by over 300 mid-senior international industry practitioners, business leaders, and regional and international representatives. GAS 2016 was the only regionally focused, strategic and technical gas event at the SIEW.

Singapore and Sharjah - United Arab Emirates to collaborate on energy sector developments

The MOU will include areas such as the promotion of efficient energy markets, the sustainable development of electricity and gas industries, and best practices in manpower development

The Energy Market Authority (EMA) and the Sharjah Electricity and Water Authority (SEWA) signed a Memorandum of Understanding (MOU) on October 27, 2016 to strengthen bilateral cooperation in the energy sector.

The MOU will establish a platform for energy cooperation and information exchange. This includes areas such as the promotion of efficient energy markets, the sustainable development of electricity and gas industries, and best practices in manpower development. The MOU will also facilitate private sector collaborations in the energy sector. It ties in closely with Singapore's collaboration with the United Arab Emirates (UAE) in sectors related to energy, water and the Internet of Things.

Mr Ng Wai Choong, Chief Executive of EMA, signed the MOU with Dr Rashid Al Leem, Chairman of SEWA, during the Singapore International Energy Week (SIEW) 2016. "We share common interests in developing our energy sectors," said Mr Ng. "I look forward to strengthening our ties with Sharjah through deepened collaboration with SEWA."

Dr Rashid Al Leem added that "the signing of this MOU between EMA and SEWA is another milestone for Sharjah and in the larger sense, the UAE. It builds upon the excellent spirit of cooperation and relationship we have with Singapore. The outcome would surely be sustainable development in the field of clean energy, as well as the pursuit of best practices".

Dr Rashid Al Leem, Chairman, Sharjah Electricity and Water Authority (SEWA) (on left) and Mr Ng Wai Choong, Chief Executive of Energy Market Authority (EMA), (right) at the MOU signing ceremony.

ASIA CLEAN ENERGY SUMMIT

The Clean Energy Leaders' Dialogue witnessed top utility leaders, PV manufacturers and developers and policy professionals exchanging best practices and debating trends and solutions in the clean energy industry

The Clean Energy Leaders' Dialogue served as the opening plenary for the Asia Clean Energy Summit by bringing together leaders in the regional solar and renewables space. The dialogue witnessed top utility leaders, PV manufacturers and developers and policy professionals exchanging best practices and debating trends and solutions in the clean energy industry. Two panel sessions - one on renewable energy integration and storage, and the other on solar were featured.

Mr. Masagos Zulkilfli, Minister for the Environment and Water Resources, announced that Singapore has launched the world's largest floating solar photovoltaic (PV) cell test-bed, and the region's first large-scale, offshore power grid system, during his opening address.

The floating solar PV cell test-bed measures one hectare and contains 10 different solar PV systems, and the offshore power grid system is approximately the size of eight football fields and will be built on Pulau Semekau.

These initiatives allow Singapore to develop a leadership role in renewable energy development in the region, said Mr. Masagos as he outlined Singapore's ambition to play its part in addressing climate change and to contribute to ASEAN's renewable energy goals.

Mr. Edwin Khew, Chairman of Sustainable Energy Association of Singapore (SEAS) added that partnerships between public and private sectors "will see greater adoption of clean energy and that it will create many new opportunities for clean energy projects".

As attention continues to focus on COP21 and global warming, more than 100 international speakers delivered insights on renewable energy, including: Goh Chee Kiong, Executive Director of the Economic Development Board (EDB) who shared an overview of Singapore's solar landscape and industry development efforts and Dr Thomas Reindl, Deputy CEO of the Solar Energy Research Institute Singapore (SERIS). These eminent speakers were joined by corporate leaders such as: Mr. Gao Jifan, CEO, Trinar Solar, Dr Lu Chuan, CEO, China Solar (Zhejian), Dr Reynaldo T. Casas, President of nv-vogt, Philippines, Mr.Dallon Kay, President & CEO, Diamond Energy Corporation, Mr. Bambang Susanto, Vice President, Knowledge Management and Sustainable Development, Asian Development Bank (ADB).

In addition, close to 60 high-level policy makers and regulators from the Sustainable Energy Centre of Excellence programme, which is aligned to the ADB, IE Singapore and SEAS attended the forum.

The first keynote was titled "An overview of global clean energy trends" and delivered by Mr. Bambang Susantono, Vice President, Knowledge Management and Sustainable Development, Asian Development Bank (ADB).

The first panel discussion was titled "Global trends in clean energy". The panel was addressed by Mr.Justin Wu, Head of Asia-Pacific, Bloomberg New Energy Finance; Mr.Steve O'Neil, CEO, Renewable Energy Corporation; Mr.Ditlev Engel, CEO, DNV GL – Energy; Mr.Bernard Salha, Senior Executive Vice President of EDF Group and President of EDF Research and Development (EDF R&D) and Mr.Vicente S. Pérez, CEO of Alternergy.

The panel discussed how renewables added more to global energy generation capacity than all other technologies combined; For the first time,

developing world investments in renewables (up 19% in 2015) topped developed nations' (down 8%); World record total of $286 billion invested in renewables last year; makes $2.3 trillion over 12 years. Despite the ambitious signals from COP 21 in Paris and the growing capacity of new installed renewable energy, there is still a long way to go.

The session covered topics like:

- Potential and barriers for scaling up penetration of clean energy in Asia.
- Policy and regulatory trends
- Funding mechanisms
- Next generation clean energy trends

The second keynote was titled "Overview of the global solar industry" and delivered by Mr. John Smirnow, Secretary-General, Global Solar Council.

The second panel discussion was titled "Scaling Solar Power- a path to reducing emissions and providing energy access". The Panel was addressed by Mr. John Smirnow, Secretary-General, Global Solar Council; Mr. Gao Jifan, CEO, Trina Solar; Dr. Lu Chuan, CEO, CHINT SOLAR, Zhejiang, CO., Ltd; Mr.R. Andrew de Pass, Global CEO, Conergy Global Solutions GmbH; Mr.David Russell, Group CEO, Equis and Mr.Ansgar Hinz, CEO, VDE – Association for Electrical, Electronic & Information Technologies (Germany). The panel was of the view that solar power is expected to be the fastest growing power generation technology over the next few years and advancements in energy storage are set to make it even more relevant.

The topics covered were:

- What are the residual barriers to bankable solar project implementation in view of developments like falling module prices, smart grids, and advanced energy storage technologies?
- What are the main hurdles that need to be overcome to accelerate the pace of storage deployment?
- Are subsidies truly the way forward for the increased uptake of solar?
- Grid parity in the power market - To regulate, or not to regulate?

Solarising Singapore and Asia PV

Given Singapore's strategic location in the Asian Sun Belt and the high cost of electricity, there has been a growing interest in solar PV over the years. The announcement of the SolarNova programme by the government, with a proposed 350 MW installed on government buildings by 2020, has made Singapore an attractive market for both local and international solar companies and financial institutions. This session provided a platform for adopters of solar to hear from the experts and understand not only the technology but also the new business model of solar leasing.

Some of the pioneering companies were presented with awards for their early and innovative adoption of solar. An overview of Singapore's solar landscape and industry development efforts were presented by Mr. Goh Chee Kiong, Executive Director, Economic Development Board Singapore along with a report on solar projects in Singapore.

'This is an exciting time for

A New Era of Clean Energy Growth

This is an exciting time for the development of clean energy. With the effects of climate change becoming more apparent, nations and leaders around the world are taking charge to make a change, bringing us into what I like to call a new era of clean energy growth. Leaders from 195 countries had gathered in Paris last December and demonstrated an unprecedented political will to combat climate change by adopting a landmark agreement to reduce greenhouse gas emissions said Mr. Masagos Zulkifli.

Earlier this month, the double threshold of 55 countries representing 55% of global greenhouse gas emissions, needed for the Paris Agreement to enter into force was crossed. At least 77 countries, including the U.S., China, the EU member states, as well as Singapore, have ratified the Paris Agreement, which is now set to enter into force on 4 November.

Clean energy solutions will play a crucial role as countries work towards a carbon-constrained future. There is vast potential for growth and innovation in this space, and countries and cities must ready themselves to ride this wave of opportunity. According

Clean energy solutions will play a crucial role as countries work towards a carbon-constrained future. There is vast potential for growth and innovation in this space, and countries and cities must ready themselves to ride this wave of opportunity: Minister Zulkifli

The panel discussion titled "Solar Landscape of Singapore" focused on Solarising Singapore through the lens of solar developers and policy makers in Singapore and addressed by Dr Thomas Reindl, Deputy Chief Executive Officer, Solar Energy Research Institute of Singapore; Mr. Dallon Kay, President & CEO Diamond Energy Corporation; Mr. Ang Kian Seng, Group Director, Environmental Sustainability Group, Building and Construction Authority (BCA), Singapore and Mr. Frank Phuan, Founder and Director, Sunseap Group Pte Ltd.

Solar power is expected to be the fastest growing power generation technology over the next few years and advancements in energy storage are set to make it even more relevant

Innovative implementation models that have been successfully applied, supported by advancements in the industry and relevant policies were shared.

The event provided a good opportunity to explore how these Singapore stories can be exported to ASEAN. The discussions covered key business and financing models to develop the PV market; Policies and regulatory environment; Getting different building categories to adopt solar energy; Integration with grid

the development of clean energy'

to a report by the United Nations Environment Programme, 2015 was the first year where more than half of all added power generation capacity came from renewables, excluding large hydro-electric projects, and this prevented the emission of some 1.5 gigatonnes of CO2, the Minister said.

Closer to home, the renewable energy market in Southeast Asia presents immense potential. According to the International Renewable Energy Agency (IRENA), energy demand among the 10 ASEAN countries will increase 50% between now and 2025, he said. The deployment of clean energy sources such as solar and wind can help to mitigate the environmental impacts of this rising energy demand. Moreover, ASEAN states are targeting a 23 per cent renewable penetration in the region by 2025.

Improving energy efficiency and deploying clean and renewable energy is an important part of our climate change mitigation and environmental sustainability efforts. In this light, we aim to contribute to ASEAN's renewable energy goal and to play our part in addressing climate change. Our Sustainable Singapore Blueprint 2015, which I will elaborate more on later, and the Climate Action Plan charts our strategy to achieve these goals, he added.

The Climate Action Plan outlines the Minister said, bold steps that Singapore will take to achieve our 2030 carbon mitigation target, as well as to strengthen our resilience to climate change. Close partnership between the Government and businesses is needed to realise these goals, such as in reducing emissions from power generation by

Address by Mr Masagos Zulkifli, Minister for Environment and Water Resources, Singapore at the joint-opening of the Asia Clean Energy Summit (ACES) 2016, the PV SEC 26, and the Asian Wave and Tidal Energy Conference (AWTEC) during SIEW 2016

Mr Masagos Zulkifli, Minister, Environment & Water Resources, Singapore

raising solar power in our system to 350 MW peak by 2020, which will be an 18 times increase as compared to 2014.

New clean energy investments in singapore underscore importance of innovation and close partnership between Government and companies in developing environmental sustainability

The paradigm of turning our challenges into opportunities for innovative developments is etched in Singapore's environmental story. We are a land-scarce, highly dense urban city-state, which gives us very little resources of renewable energy. However, this also creates opportunities for us to innovate and become a global leader in urban solar solutions, thus allowing us to maximise our deployment of

The PV Asia Financial Summit during SIEW shaped the regional solar energy market through knowledge exchange with key influencers. The agenda was designed to enable the participants to stay up to date with the latest developments and opportunities

and successful case study of a large scale system adoption.

The discussion brought together clean energy leaders from Singapore and ASEAN to talk about exploring strategic solar deployment opportunities in growth markets in the region like Thailand, Philippines, India, Indonesia and Malaysia.

The panel was addressed by Dr. Reynaldo T. Casas, President, Confederation of Solar Developers of the Philippines, Inc.; Mr.Atem S. Ramsundersingh, Founder, CEO and Member of the Board of WEnergy Global; Mr.Leonardo Botti Global Marketing Manager, ABB; Mr.Daniel Gäfke, Managing Director BayWa r.e. Solar Pte Ltd, Singapore; Dr. Umakant Panwar, Principal Secretary, Power, Uttarakhand, India and Mr.Raju Shukla, Founder and Chairman, Cleantech Solar.

The session also provided a regulatory overview of the most up-to-date policies and government support for the solar industry in these countries, threw light on practical issues like grid access and land leasing highlight the role of off-grid rural electrification in empowering villages and potential opportunities explore the rooftop boom in ASEAN identify areas or risk and steps for mitigation for solar development projects in ASEAN.

PV Asia Financial Summit

The PV Asia Financial Summit shaped the regional solar energy market through knowledge exchange with key influencers. The agenda was designed to enable the participants to stay up to date with the latest developments and opportunities. Some of the region's solar project developers, private investors, multilateral agencies, insurers, and industry players spoke who tackled the most relevant issues: optimal business models for bankability, risk mitigation, quality assurance, project insurance and best practices for raising various types of financing.

The first panel of the PV Asia Financial Summit focused on the role of multilaterals and donor agencies in clean energy projects. An overview of the facilities and initiatives of donor agencies active in Asia were taken up. It also covered issues concerning technical assistance, capacity development and catalysing start-up ideas.

The panel also discussed how do donor agencies help overcome challenges that traditional financiers cannot support with? How can donor agencies empower the transition from fossil fuels to renewables? What advice do donor agencies have for project developers that want to work with them? What are the issues in the solar industry

renewable energy despite these constraints.

Given our geography, solar photovoltaic (PV) systems are a key technology in Singapore's efforts to harness renewable energy. Floating PV systems, ie those installed over our water bodies, not only help to overcome land constraints, but also have the potential to reduce evaporative losses from our reservoirs. In turn, there could be improved solar panel performance due to the cooling effect of water.

I am pleased the Minister said to say that we have substantially completed the installation of 10 different floating Solar PV systems on water at Tengeh Reservoir, as part of Phase 1 of our test-bed. Led by the Economic Development Board (EDB) and PUB, our national water agency, and managed by the Solar Energy Research Institute of Singapore (SERIS), this pilot aims to test a variety of flotation systems and PV modules to determine the optimal system for Singapore and to study the environmental impact of such systems on our water bodies. The findings from Phase 1, which has a capacity of about 1 MWp, will guide the deployment for a larger 2MWp system in Tengeh Reservoir next year.

This pilot project is first-of-its-kind worldwide because of the sheer variety of floatation systems and PV modules tested, and the rigour involved in studying the environmental impact of floating PV systems. If this pilot successfully establishes the economic viability and environmental sustainability of floating solar PV systems, Singapore will explore the large-scale deployment of these systems.

Such clean energy test-beds in Singapore underscore the importance of innovation and close partnership between the Government and industry

that donors face and how can these be addressed?

The second panel session focused on: The opportunities for corporations and private end users in the solar market; What are the opportunities for corporate and private end users to go solar, especially taking into account electricity market liberalization?; Which business models such as solar leasing and PPAs are available for this market segment in Asia?; What are the options for raising financing and what are the prerequisites for tapping these?; What are the challenges these end users face in adopting solar?; How can users hedge their risks?

The third panel session focused on outlook on: Private sector solar investment in Asia; What are some of the market dynamics and financial innovations that are driving investment in the region? How has electricity market liberalization opened up investment opportunities in solar?; How much growth has there been in solar leasing, and what can be done to further encourage it?; What is the potential for YieldCos in Asia?; Outlook on raising project financing through capital markets; What are the particular regional risks that investors have to deal with?; How can investor risk be mitigated?

The fourth panel session covered subject like: Driving sustainability in solar; A utility's perspectives on the grid integration of small & medium-scale PV systems: experiences, challenges and necessary

in developing environmental sustainability. They allow Singapore to develop a leadership role in renewable energy development in the region.

Singapore aspires to achieve regional leadership in microgrids

Singapore also aspires to achieve regional leadership in microgrids. 134 million people, or 20 per cent of Southeast Asia's population still lack access to electricity. Regional governments are exploring the possibility of deploying microgrids as an alternative power infrastructure to the main grid. In addition, for grid-connected communities with poor power quality, microgrids are able to help increase the resiliency and stability of the main power supply. A report by Navigant expects that the microgrids market in Asia Pacific will grow at a compound annual growth rate of 32.8% to account for 40% of the global market by 2020.

As such, the Nanyang Technological University (NTU), with support from EDB, launched the Renewable Energy Integration Demonstrator Singapore (REIDS) platform on Semakau Landfill in 2014 to develop and demonstrate microgrid technologies. On this note, I am happy to announce Mr. Zulkifli said that the first microgrid has just been deployed and it will enable the National Environment Agency (NEA) to power its infrastructure on Semakau Landfill using electricity generated through zero-carbon means. The use of energy storage and microgrid control technologies will allow the landfill to reduce its reliance on diesel-based power and transition towards renewable energy. I am also pleased to share that REIDS will deploy 3 further microgrids on Semakau Landfill to test the interoperability of various microgrid solutions, he added.

REIDS has attracted a wave of investments from top energy and microgrids players such as Accenture, DNV GL and Schneider Electric. Today, REIDS will be signing new partnerships with Sony on energy storage and LS Group, a major South Korean conglomerate, on microgrids software controls. REIDS has also developed strong traction amongst regional adopters. For instance, Bawah Island Resort on a remote Indonesian island, and Meralco, the largest electric distribution company in the Philippines, will partner REIDS to develop microgrids projects. The REIDS platform will therefore pave the way for similar solutions to be developed and exported to serve the fast-growing microgrids market in Southeast Asia and beyond, he said.

Achieving a Leading Green Economy

The Sustainable Singapore Blueprint 2015 (SSB2015) sets out our national vision and plans for the next phase of sustainable development until 2030. It encapsulates our belief that we can have a balanced approach towards attaining the twin goals of growing the economy and protecting the environment. There are five focus areas identified to achieve this vision, one of them is to build a leading green economy.

Being sustainable should not be considered as an alternative or a trade-off to economic development. Rather, the pursuit of clean and renewable energy development is a venture into greater opportunities and growth, and also a necessary step into the new green era. There is much more that we can do, and I hope that new partnerships and collaborations can be forged and strengthened at this conference and exhibition, as we work together towards a clean and sustainable Singapore, Mr. Zulkifli emphasised.

The 26th International Photovoltaic Science and Engineering Conference during SIEW shared the latest developments in PV materials, devices, modules and systems

improvements; Experiences with project quality in Southeast Asia and how to streamline quality assurance in an era of reducing margins; Best practices for solar asset management – preventing under performance and enabling lucrative projects for the secondary market; Risk mitigation to reduce financing and insurance costs What are the different options for project insurance and what to look out for when evaluating revenue shortfall coverage?; The potential opportunities for integrating energy storage into PV projects in Asia.

The following points were brought out during the joint wrap-up session:

Scientific topics:

- What are some key technological trends that will drive the fundamental shifts in energy use, generation, distribution and export?
- Upstream technologies / efficiency trends
- How does the shift of focus from $/W to $/kWh (or LCOE) affect R&D in the PV sector?

Financial topics:

- How can the solar industry leverage on multilateral agency support and what should project developers consider when working with multilaterals?
- What are the financial innovations that are driving solar investment in Asia?
- What are some options and best practices for pro risk mitigation?

Held alongside, the RE Asia conference during SIEW 2016 brought together academics, researchers, professional engineers, government policy makers, and business professionals from the domains of Renewable Energy Integration, Offshore Renewable Energy; Micro-grids, Smart Grids & Energy Storage; and Grid Interactions of Electro-mobility. A glimpse of some of the these areas are as under:

The 26th International Photovoltaic Science and Engineering Conference (PVSEC-26): PV Asia was also held alongside. It provided an excellent platform for the world's PV scientists, engineers and specialists to showcase and share the latest developments in PV materials, devices, modules and systems.

Asian Wave and Tidal Energy Conference (AWTEC 2016): RE Asia covered topics that spanned the fields of offshore renewables research – wave and tidal energy research with offshore wind and OTEC, ranging from technical to cross-cutting policy, finance and environmental subjects.

Asian Conference on Energy, Power and Transportation Electrification (ACEPT 2016): It was the first Asian Conference on Energy, Power and Transportation Electrification that was a part of Asia Clean Energy Summit in cooperation with the Institute of Electrical and Electronics Engineering (IEEE) to bring together the world leading experts to present emerging topics on energy, power and transportation electrification.

The Digital World & the Future of Energy: It discussed that Internet of Things (IoT) is the next generation of the internet. It is a global system of IP-connected computer networks, sensors, actuators, machines, and devices. Merging the physical world with the virtual world of the internet and with software enables companies and consumers to create new services that are founded on web-based business models.

Asian Conference on Energy, Power and Transportation Electrification during SIEW focused on emerging topics on energy, power and transportation electrification

Industry 4.0 describes a new, emerging structure in which manufacturing and logistics systems in the form of Cyber-

The Digital World & the Future of Energy during SIEW focused on Internet of Things

Physical Production Systems (CPPS) make use of available global information and communications networks. This is done through an extensively automated exchange of information in which production and business processes are matched. The fundamental objective is to utilize the progress achieved thus far in information and communication technologies, as well as technologies expected in the near future for the benefit of manufacturing enterprises. Preparation therefore has to be made for the increasing and consistent embedding of these technologies in production systems and in ever smaller partial systems and components, it was discussed.

In the wake of the energy world moving towards decentralization and digitalization power generation from huge numbers of renewable energy systems and virtual power plants needs to be fed into distribution networks. Stationary storage and electric cars will play a part in supporting the grid and unlocking the higher penetration of renewables, according to experts at the event. Consumers will use energy in more efficient ways, while at the same time enjoying more functionality and comfort from systems in their homes. The smart home, which takes advantage of internet-based systems, uses information and communication technology to manage energy consumption and control safety and security aspects as well. The integration of communication systems in infrastructure is a key requirement for networking between smart meters, smart grids, smart homes and e-mobility it was discussed.

In the energy storage space, technology and economics must continue to improve, and business models use cases, proper verification of safety, performance and reliability, and financing products need to be developed and adopted in the market. In the digital world, the key considerations that must be worked out to foster customer acceptance of smart technologies are the smooth interoperability between these different systems, information security, and data protection to enable optimized operation and performance. Standards will help guide developments in these fields and serve as a reference point for main stakeholders such as customers, financiers and insurers, according to the experts.

ASIAN DOWNSTREAM WEEK 2016

With over fifty speakers, thirty international exhibitors and around six hundred participants, this year's agenda of Asian Downstream Meet organised by the World Refining Association revolved around the theme: "Achieving Operational Excellence through Digital Transformation" with an in-depth focus on digital manufacturing & automation, connected supply chain and operational excellence & Asset optimisation.

With a wider focus on the petrochemical industry (including specialty chemicals) and new focused stream on automation and digitalisation, the region's largest downstream-focused the event showcased keynotes and presentations led by leading industry experts on the two-day, three track conference programme which included Mr. Claus J. Nehmzow, Digital Innovation Organisation Asia Pacific, BP Singapore Pte Ltd; Mr.Vishal Mehta, Head of Digital Strategy, Architecture and Technology, Reliance Industries; Mr.Vikas Prabhu, CIO - Oil, Gas and Retail, Essar Group; Mr.Martin Hawkins, COO, HMEL; Dr Kishor Dongaonkar, VP - Technology Center of Excellence, Reliance Industries; Mr.P S Moorthy,

Asian Wave and Tidal Energy Conference during SIEW covered topics that spanned the fields of offshore renewables research

Engineering Services Manager - Downstream Manufacturing, Shell Eastern Petroleum; Dr. Werner Reimann, Senior Expert Application Development Fuel Additives, Clariant Produkte; Mr.Selva Guru, Principal Engineer, Singapore Refining Company; Mr.Sharul Rashid, Principal Engineer - Instrument and Control, Petronas Penapisan Terengganu; Mr.Abdullah Dhafer, Operational Excellence Leader, Saudi Aramco; Mr. Sudhagar Raghavan, Manager - Global Lean & Operational Excellence, BASF; Mr.Mai Tuan Dat, Production Manager, Binh Son Refining & Petrochemical and Mr. Charles Nie, E-business and Supply Chain Optimization Manager, Covestro besides a host of other eminent speakers.

Mr. Claus J. Nehmzow, Digital Innovation Organisation Asia Pacific, BP Singapore Pte Ltd shared key technologies and innovations that BP is exploring to meet future business challenges.

The prominent areas discussed during the two days were related to building the digital enterprise and executing an enterprise approach to operational excellence.The event explored information technology innovations and dug deep into how digital manufacturing and automation technologies can help process operators achieve their throughput and efficiency priorities. The newly developed three key sub themes during this year were: Digital Manufacturing & Automation, Connected Supply Chain, and Operational Excellence & Asset Optimisation.The event explored technological innovations and unearthed the capabilities of digital manufacturing and automation technologies that can enable process operators achieve efficient throughput.

Asian Downstream Week 2016 organised by the World Refining Association revolved around the theme: "Achieving Operational Excellence through Digital Transformation" with an in-depth focus on digital manufacturing & automation, connected supply chain and operational excellence & Asset optimisation. The event had a wide focus on the petrochemical industry (including specialty chemicals)

The event witnessed IOC and NOC refinery and petrochemical operators, technology licensors, EPC's and other key industry players come together to meet and discuss investment and collaboration opportunities, key projects, technology licensing, feedstock supply and security.

High level papers and new developments out of the work environment of refiners, EPCs, Catalyst companies, chemicals & equipment providers were presented.

Some of the technical presentations focusing on the latest products, in-depth market knowledge and solutions which ran parallel to the conference touched the following areas:

- A Path to Minimizing Operations Risks and Achieving Transformative Change by Dr. Ankur Pariyani, Chief Innovation Officer, Near-Miss Management LLC
- Creating Value from Naphtha and Kerosene Streams with Catalytic Solutions by Dr. Rainer Rakoczy, Global Product Manager Fuel Upgrading Catalysts, BU Catalysis, Clariant and Mr. Vincent Mok, Regional Sales Manager, APAC, Clariant
- MS Plastic Pallet – Right Choice for a More Sustainable Future by Mr. Alvin Chuah, Senior Sales & Marketing Manager, Mah Sing Plastics Industries.
- Collaborating with 3d models

for improved operability and maintainability by Mr.Steve Sullivan, Vice President Oil & Gas Asia, Aconex.
- Achieve Turnaround Excellence by Ms. Anne Hollonds, Senior Consultant, Asset Performance Networks, LLC
- Metal recovery from spent catalysts by Ms.Shinichi Watanabe, Sales Section Manager, Taiyo Koko
- Cleaning Coker Units: Best Practices by Dr Steve Matza, Chief Scientist, Zyme-Flow Decon Technology.
- Princeps Scheduling Solution innovation by Mr. Guillaume Moulin and Lionel Berton, Senior Consultant, Princeps
- ABB Laser Level technologies for Downstream Measurements by Josée Labrecque, Business Development Manager for Laser Level and Volume Measurement, ABB
- Value Add to Supply Chain: Ship Dangerous Goods Efficiently by Mr. Jay Kwek, Area Sales Manager, DG Packaging Pte Ltd

Mr. S. Iswaran, Minister for Trade & Industry (Industry) along with the winners of the various students of innovative projects at the Youth@SIEW Pavilion

YOUTH SIEW 2016

Earlier at Youth@SIEW, students engage with Mr S. Iswaran, Frank Phuan, Founder and Director, Sunseap Leasing, and Valerie Lee, General Manager, Sembcorp Power at In Dialogue with Youth, while the Youth Energy showcased student projects. Mr. Iswaran also presented the Energy-Industry Scholarships to students on the occasion. The Energy-Industry Scholarship recipients were Fazlie Bin Mohamad Ramdam, 18, from Ngee Ann Polytechnic who received the scholarship from Senoko Energy; Benjamin Chang and Goh Sian Ming, both 23, from Nanyang Technological University who received their scholarships from Singapore Power.

Youth@SIEW is a platform to excite young leaders on global energy developments and understand how innovation can create a sustainable future.

Over the past one year, Singapore's solar take up rate has been moving quite quickly. Solar is now increasingly competitive, and the EMA of Singapore continues to strive to make it as easy as possible for companies and individual households to use solar as an energy source for their own consumption. As a result, solar now makes up around 1% of Singapore's total energy mix, said Frank Phuan, founder of Sunseap Leasing. The nation aims to achieve 5% solar in the energy mix by 2020.

Today's youth have even higher aspirations for the energy source. Nearly 40% of the participants at In Dialogue with Youth said they believed that solar energy currently supplies 25% of Singapore's energy. Separately, 32.7% said that Singapore should aim to achieve 100% of solar energy usage.

Achieving 100% solar usage is nearly impossible, due to natural limits including the sunlight's radiance, cloudy skies and stormy weather, said Minister for Trade & Industry (Industry) S. Iswaran. That said, government agencies such as Economic Development Board (EDB), EMA, Housing & Development Board (HDB) and JTC Corporation are working together to create solar solutions for energy diversity, he added. For example, the Singapore government supports the improvement of technologies and energy efficiency – instead of subsidies – to ensure that solar is a viable and long-term energy option.

Building on the youths' interest in solar energy, Mr. Iswaran urged the Youth in Dialogue audience to consider a career in the energy industry. The energy industry is diverse, with many areas such as clean energy, generation, transmission & distribution, and energy efficiency – all of which require people with different skills, he said.

People with passion and interest to join the industry can expect a rewarding career. In response to a survey, most youths are keen to join either the clean energy or power sector, citing the ability to upgrade skills through career and good pay as reasons. For those interested, the SkillsFuture initiative is a way for youths to access energy technology. Companies and organisations can work with educational institutions to share their industry knowledge with, and create opportunities for youths to learn more about a career in energy. dewjournal.com